Saskatchewan
Agriculture, Food
and Rural
Revitalization

ADF

AGRICULTURE DEVELOPMENT FUND

FINAL REPORT

19990306

POST-EMERGENT INJECTION OF SWINE MANURE ON WHEAT OR BARLEY

Funded by:
The Agriculture Development Fund

March 2004
Prepared by: Prairie Agricultural machinery Institute

104-06142/

Project No. 5200G
Date: January 30, 2004
Revised: March 17, 2004
Tested at Humboldt

ADF#19990306

Final Report

Post Emergent Injection of Swine Manure on Wheat or Barley

Wayne Stock, A.Sc.T.
Assistant Manager
Soils and Crops

Gordon Hultgreen, P.Ag., M.Sc.
Manager
Soils and Crops

Philip Leduc, P.Eng.
Senior Manager
Research and Development

Acknowledgement

PAMI wishes to acknowledge the funding support provided by the Agriculture Development Fund of the Saskatchewan Department of Agriculture and Food.

Table of Contents

Page

1. Summary 1

2. Technical Report 3
   - 2.1 Background and Objectives 3
   - 2.2 Project Description 3
   - 2.3 Results and Discussion 6
     - 2.3.1 2000 Results 7
     - 2.3.2 2001 Results 9
     - 2.3.3 2002 Results 11
     - 2.3.4 2003 Results 14
     - 2.3.5 Combines Results 15
   - 2.4 Conclusions 16

5. Equipment 19

6. Project Materials 20

7. Project Photos 21

8. Acknowledgement 35

Appendix I 2000 Project Data 36
Appendix II 2001 Project Data 45
Appendix III 2002 Project Data 57
Appendix IV 2003 Project Data 70

1. Summary

The objective of this project was to determine the protein and yield effects of low disturbance post emergent swine manure injection on wheat or barley. Higher protein wheat commands a premium and higher protein barley is of increased value as a feed source. New low disturbance manure injection equipment offers the possibility of injecting manure in-crop after emergence to boost grain protein. In this study, alternative rates of application and timing of application were investigated.

In the 2000 crop year, there was a significant grain yield response to post emergent injected swine manure with an average yield increase of 236 kg/ha (3.5 bu/ac) for the 33,700 L/ha (3,000 gpa) injection rate compared to the disturbed check. June 30 and June 15 injection dates resulted in significantly higher grain yields compared to the June 1 injection date. The 33,700 L/ha (3,000 gpa) application rate resulted in significantly higher grain yields compared to the disturbed check, and the 11,233 L/ha and 22,647 L/ha (1,000 gpa and 2,000 gpa) application rates.

The injection of swine manure resulted in significant grain protein increases compared to the disturbed check with an increase of 0.7% at 11,233 L/ha (1,000 gpa), 1.4% at 22,647 L/ha (2,000 gpa), and 1.8% at 33,700 L/ha (3,000 gpa).

In the 2001 crop year, Site 2 yielded better than Site 1 and the application date significantly affected yield with greater crop damage and lower yields at later injection dates. Compared to the disturbed check at each interval, manure application did not produce significant yield increase, in part due to dry conditions. Tissue N analysis indicated a good N fertility (5% N) prior to post emergent injection so a yield response was unlikely. Protein was increased by up to 1% by the 22,647 L/ha (2,000 gpa) rate and nothing further for the higher rates. Late disturbance (June 13 and June 27) was responsible for a significant yield reduction 672 to 1,008 kg/ha (10 to 15 bu/ac) and overall post emergent application in 2001 after the end of May would have a negative economic affect.

In 2001, the later injection dates resulted in increased crop damage, which was still visible at harvest and wheel tracks had delayed ripening, which resulted in uneven maturity. It was also noted that the higher injection rates had slightly delayed maturity as injection rates increased.

In the 2002 crop year, Site 1 yielded higher than Site 2, which may be attributed to better soil moisture since Site 1 was on summerfallow. Early application (June 7) produced higher yields than later applications (June 21 and July 5). The last application date, in particular July 5, was associated with yield reduction. There was not much difference in yield between June 7 and June 21 application dates. The late disturbance (July 5) alone produced significantly lower yield, indicating that disturbance itself was having a negative impact, possibly due to stand injury and/or drying out of the soil surface. This was observed at both sites.

There was a general trend towards higher protein levels as manure rates increased in 2002, although there was a wide variance in response due to application date.

In 2003, the year started out with excellent precipitation followed by below normal precipitation in July and August. Overall there was a small but significant effect of post emergent manure application on wheat yield. In contrast, increases in grain protein due to manure application were highly significant with an increase in protein concentration with each incremental increase in manure application rate.

In conclusion, post emergent manure application is an effective means of boosting protein and will also increase yields in years of adequate rainfall and moisture reserves. Late application results in wheel track crop damage that may offset the benefits of manure application. In dry years, post emergent manure application, especially at later application dates, may cause serious crop damage resulting in yield and income loss.

2. Technical Report

2.1 Background and Objectives

The value of wheat and feed barley crops can be enhanced by boosting protein levels. Hopefully, a later application of N during the growing season would tend to bring about an increase in grain yield and protein, rather than increased biomass as results from higher N levels applied at seeding. Currently some producers top dress commercial fertilizer on growing crops to achieve this result. New manure injection equipment can inject hog manure without extensive soil disturbance and probably with minimal crop damage if applied early in the growing season. Grain and hog producers or those near larger hog operations may wish to use swine manure for this purpose. Since injection will cause some crop damage, the timing of injection relative to crop growth is important as well as the rate of application.

This project examined the effect on yield and protein of various dates of injection, and rates of application in wheat crops over a three-year period.

2.2 Project Description

The project was conducted at two sites/year within an 80 km (50 mi) radius of Humboldt for the first three years of the study and one site in 2003. Each year of the four-year study, new sites were selected as the application was intended to affect the crop only in the year of application. The plots were put down on land seeded to wheat and on land that had not been treated within the previous two or more years with swine manure. The farmer seeded and fertilized the land and the manure treatments supplemented the farmer's normal stubble fertilizer treatment. Soil samples were taken at each site prior to manure application.

The project used a randomized complete block design with four replicates. Plot size was 3 m by 30.5 m (10 ft by 100 ft). Swine manure was injected with the PAMI low disturbance coulter injection system in 2000 and the PAMI manure truck was used for the following years. Each tank load of manure was sampled for later nutrient analysis to determine exact nutrient application rate. Prior to the first manure application, Soil Science, University of Saskatchewan, sampled and tissue analyzed plants on each plot for C, N, and S. To determine the effect of timing of injection, the plots had manure application dates of about June 1, June 15, and June 30. Timing of application varied depending on the growing season and crop development.

Treatments:

1. Check – no disturbance.
2. Check – disturbed June 1.
3. 11,233 L/ha (1,000 gpa) injected June 1.
4. 22,647 L/ha (2,000 gpa) injected June 1.
5. 33,700 L/ha (3,000 gpa) injected June 1.
6. 11,233 L/ha (1,000 gpa) injected June 15.
7. 22,647 L/ha (2,000 gpa) injected June 15.
8. 33,700 L/ha (3,000 gpa) injected June 15.
9. 11,233 L/ha (1,000 gpa) injected June 30.
10. 22,647 L/ha (2,000 gpa) injected June 30.
11. 33,700 L/ha (3,000 gpa) injected June 30.

Each plot had a partial strip harvested with a small plot combine. Yield samples were cleaned, weighed, and the samples analyzed by Soil Science for C, N, and S.

Plots were trimmed and signed, and a tour conducted in cooperation with Sask Ag and Food each summer.

In Spring 2000, two wheat fields were selected for the test in the Leroy area. Site 1 (Troop site) was seeded with AC Barrie HRSW, and Site 2 (Henning site) was seeded with Prodigy HRSW. Both were seeded May 6 or May 7 at 134 kg/ha (119.6 lb/ac) applied with a Harmon triple shoot opener with paired row seed placement and anhydrous ammonia placed below the seed rows at 62 kg/ha (55.3 lb/ac) of N and 24 kg/ha (21.4 lb/ac) of P_2O_5, and 10 kg/ha (8.9 lb/ac) of K.

Manure was applied with the PAMI low disturbance manure injector on June 6, June 15, and June 23, which were the dates closest to planned dates where soil conditions and equipment availability would allow for placement (**Figures 1** and **2**). Plots were harvested August 23, 2000, and the data obtained is included in **Appendix I**.

In spring of 2001, two sites were once more selected. Site 1 was located on the Gerald McGrath farm on canola stubble, seeded to AC Barrie wheat at 134 kg/ha (120 lb/ac), on May 6, 2001 and fertilized with a 202 kg/ha (180 lb/ac) fertilizer blend. Site 2 was located at the Henning farm, NE9, TP35, R20, W2 and was seeded on May 5 to Prodigy wheat at 134 kg/ha (120 lb/ac) seed rate and also fertilized with a 202 kg/ha (180 lb/ac) fertilizer blend. Manure was applied May 31, June 13, and June 27. Plots were harvested August 29 and August 30 and the data is included in **Appendix II**.

In Spring 2002, two sites west of Humboldt were selected for the project. Site 1 was located north of PAMI's long-term manure site (SW28, TP37, R23 W2) on fallow seeded to AC Barrie wheat at 117 kg/ha (105 lb/ac) on May 10 and fertilized with a 142 kg/ha (127 lb/ac) fertilizer blend. Site 2 was located 3.2 km (2 mi) west and 0.8 km (0.5 mi) south of Site 1 (NW24, TP37, R24, W2) on stubble seeded to AC Barrie wheat at 117 kg/ha (105 lb/ac) on May 15 and fertilized with a 347 kg/ha (217 lb/ac) fertilizer blend. Manure was applied June7, June 21, and July 4. Plots were harvested August 28 and the data is included in **Appendix III**.

In Spring 2003, one site on Kenton Possberg's farm, approximately 11 km (7 mi) south of Humboldt, was selected for the project. The field was seeded to Snowbird wheat on May 1, 2003, at a seed rate of 100 kg/ha (80 lb/ac). Nitrogen and phosphate fertilizer was placed to the side of the seed with Atom Jet openers at 71 kg/ha (63 lb/ac) N and 27 kg/ha (24 lb/ac) P_2O_5 (**Appendix IV**).

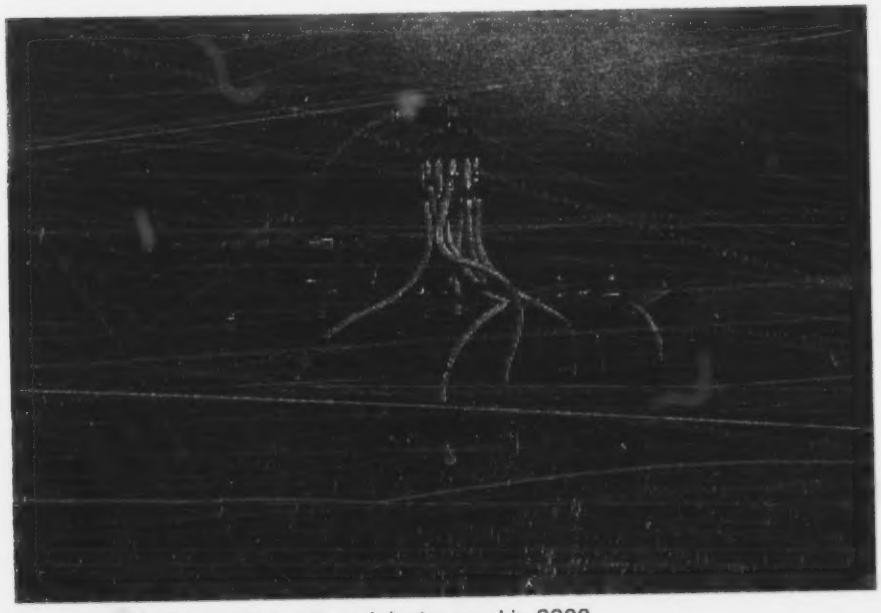


Figure 1. PAMI Low Disturbance Injector used in 2000.

Figure 2. Modified Bourgault Mid Row Coulter.

2.3 Results and Discussion

Initial results from the work in 2000 crop year were quite positive. Results in the 2001 crop year were poor, probably due to drier conditions with crop damage leading to loss of yield for injection dates after the end of May. Analysis of yield and protein has been completed by Dr. S. P. Mooleki and Dr. J. Shoeneau of the U of S. Application rates in 2000 were determined to be 24, 48, and 72 kg/ha (21, 43, and 64 lb/ac) of ammonium nitrogen on June 6; 21, 42, and 63 kg/ha (19, 38, and 56 lb/ac) on June 19; and 22, 44, and 66 kg/ha (20, 39, and 59 lb/ac) on June 23. Yields on Site 2 (Henning site) were much higher than Site 1 (Troop site) overall.

In 2001, application rates of ammonium nitrogen at Site 1 were on May 31; 32, 64, and 96 kg/ha (28.5, 57, and 85.5 lb/ac) on June 13; 48.5, 97, and 145.5 kg/ha (43, 86, and 129.5 lb/ac) and on June 27; 50, 100, and 150 kg/ha (44.5, 89, 133.5 lb/ac). Application rates at Site 2 were May 31; 29, 58, and 87 kg/ha (26, 52, 77.4 lb/ac) on June 13; 33.4, 66.8, and 100.2 kg/ha (29.7, 59.5, and 89.2 lb/ac) and on June 27; 38.2, 76.4, and 114.6 kg/ha (34, 68, and 102 lb/ac).

In 2002, application rates of ammonium nitrogen on June 7 were 22, 45, and 67 kg/ha (20, 40, and 60 kb/ac); on June 21 were 18, 36, and 54 kg/ha (16, 32, and 48 lb/ac); and on July 4 were 25, 50, and 75 kg/ha (22, 44, and 66 lb/ac).

In 2003, manure rates were applied at the same rates as in previous years. Manure analysis for 2003 was not available at the time of publication.

2.3.1 2000 Results

Overall in 2000, there was a significant grain yield response to post emergent injected swine manure with an average yield increase of 236 kg/ha (3.5 bu/ac) for the 33,700 L/ha (3,000 gpa) injection rate compared to the disturbed check. June 15 and June 23 injection dates resulted in significantly higher grain yields compared to the June 6 injection date. The 33,700 L/ha (3,000 gpa) application rate resulted in significantly higher grain yields compared to the disturbed check, and the 11,233 L/ha (1,000 gpa) and 22,647 L/ha (2,000 gpa) application rates (**Figure 3** and **Figure 4**).

The injection of swine manure resulted in significant grain protein increases compared to the disturbed check with an increase of 0.7% at 11,233 L/ha (1,000 gpa), 1.4% at 22,647 L/ha (2,000 gpa), and 1.8% at 33,700 L/ha (3,000 gpa) (**Figure 5** and **Figure 6**).

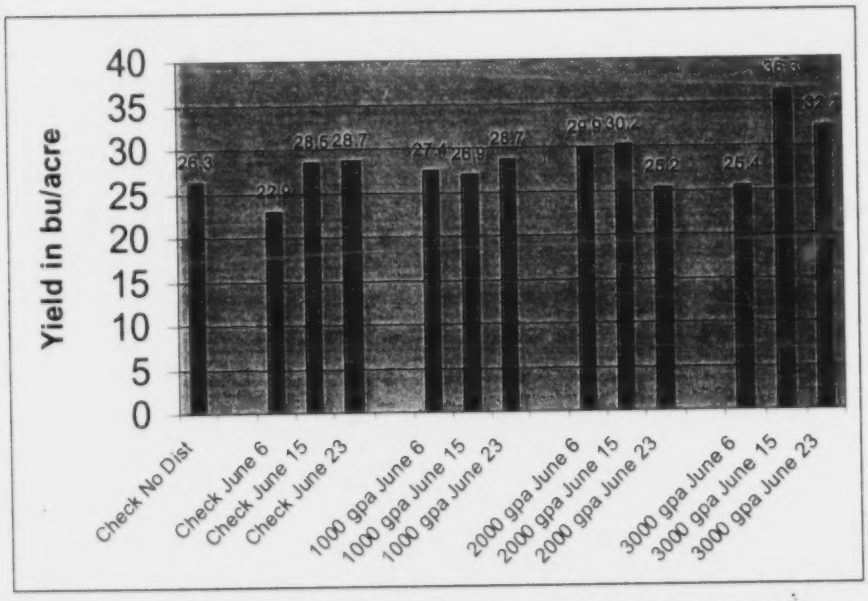


Figure 3. Effect of Post Emergent Injection of Swine Manure on Wheat Yield Site 1, Summer 2000.

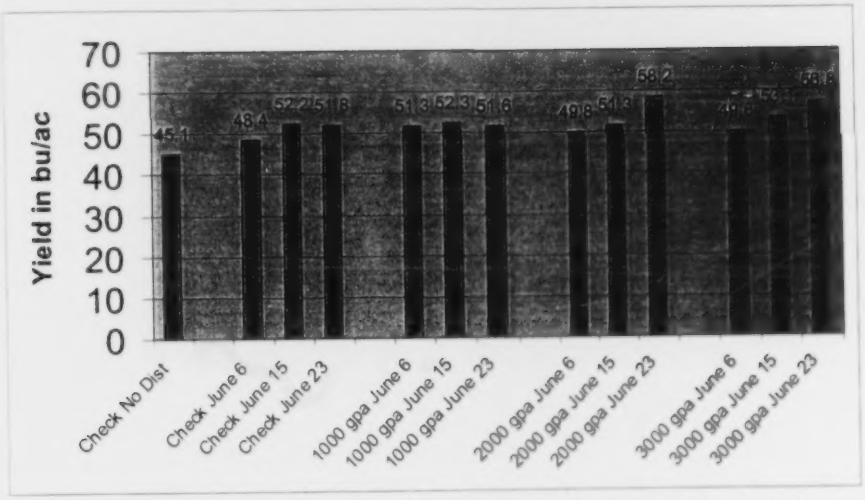


Figure 4. Effect of Post Emergent Injection of Swine Manure on Wheat Yield – Site 2, Summer 2000.

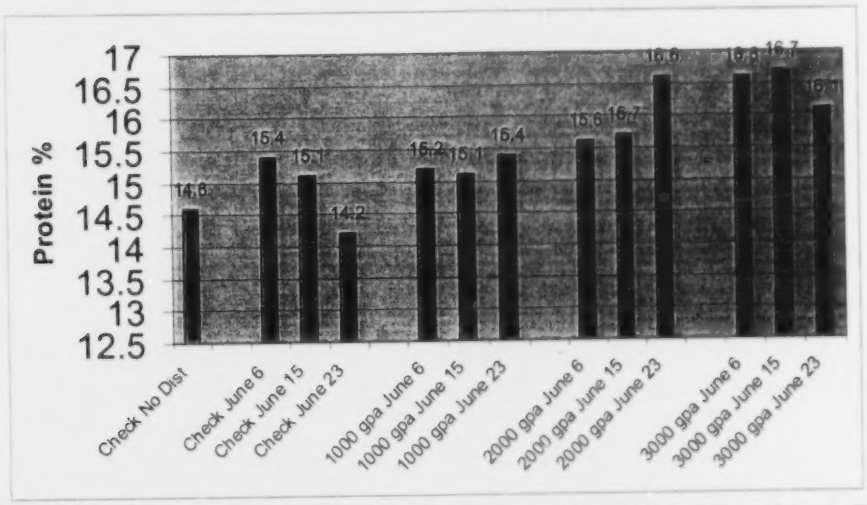


Figure 5. Effect of Post Emergent Injection of Swine Manure on Wheat Protein – Site 1, Summer 2000.

2.3.1 2000 Results

Overall in 2000, there was a significant grain yield response to post emergent injected swine manure with an average yield increase of 236 kg/ha (3.5 bu/ac) for the 33,700 L/ha (3,000 gpa) injection rate compared to the disturbed check. June 15 and June 23 injection dates resulted in significantly higher grain yields compared to the June 6 injection date. The 33,700 L/ha (3,000 gpa) application rate resulted in significantly higher grain yields compared to the disturbed check, and the 11,233 L/ha (1,000 gpa) and 22,647 L/ha (2,000 gpa) application rates (**Figure 3** and **Figure 4**).

The injection of swine manure resulted in significant grain protein increases compared to the disturbed check with an increase of 0.7% at 11,233 L/ha (1,000 gpa), 1.4% at 22,647 L/ha (2,000 gpa), and 1.8% at 33,700 L/ha (3,000 gpa) (**Figure 5** and **Figure 6**).

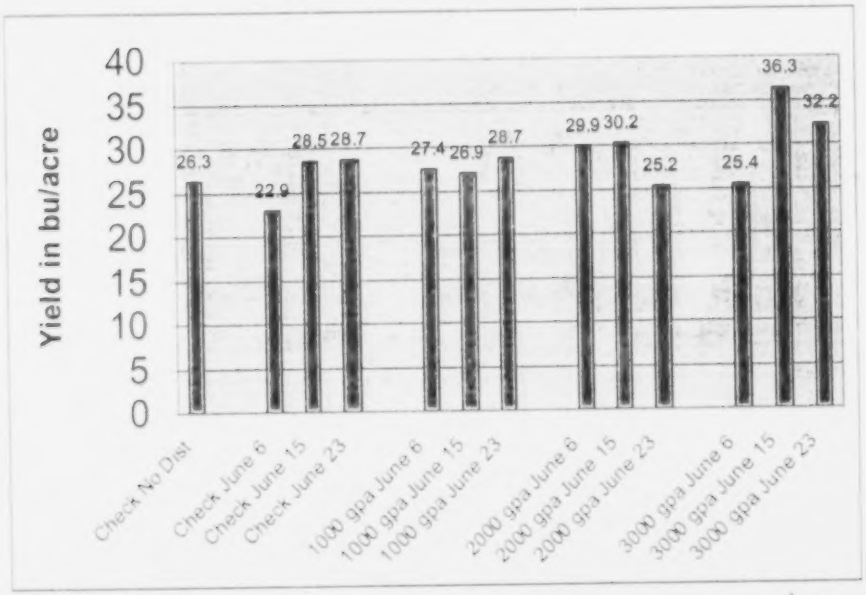


Figure 3. Effect of Post Emergent Injection of Swine Manure on Wheat Yield Site 1, Summer 2000.

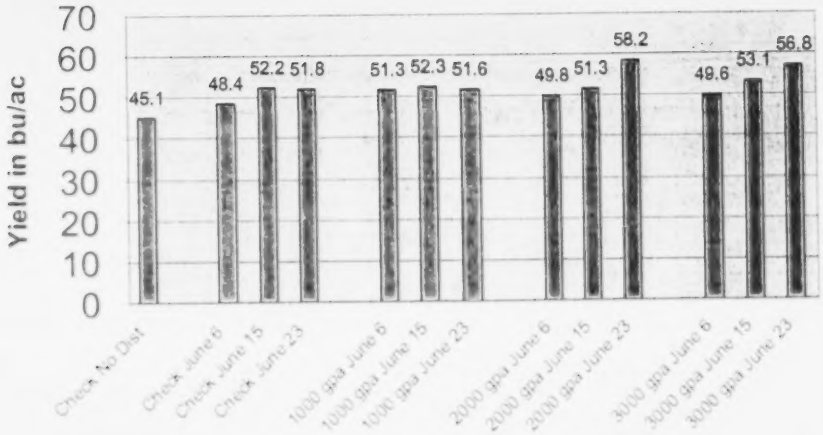


Figure 4. Effect of Post Emergent Injection of Swine Manure on Wheat Yield – Site 2. Summer 2000.

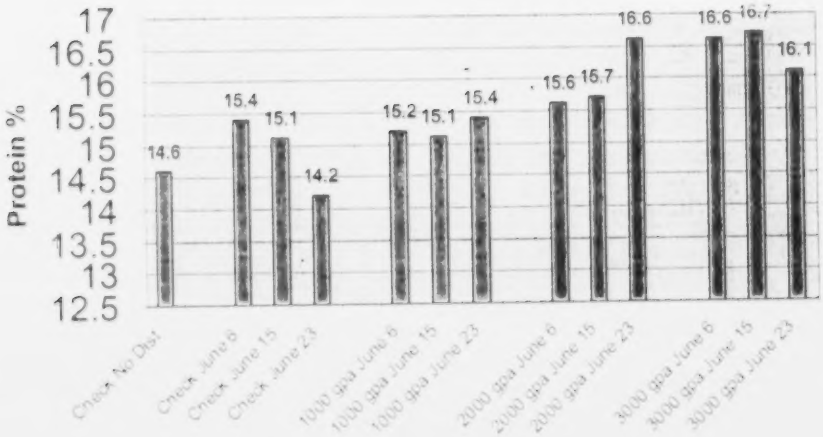


Figure 5. Effect of Post Emergent Injection of Swine Manure on Wheat Protein – Site 1. Summer 2000.

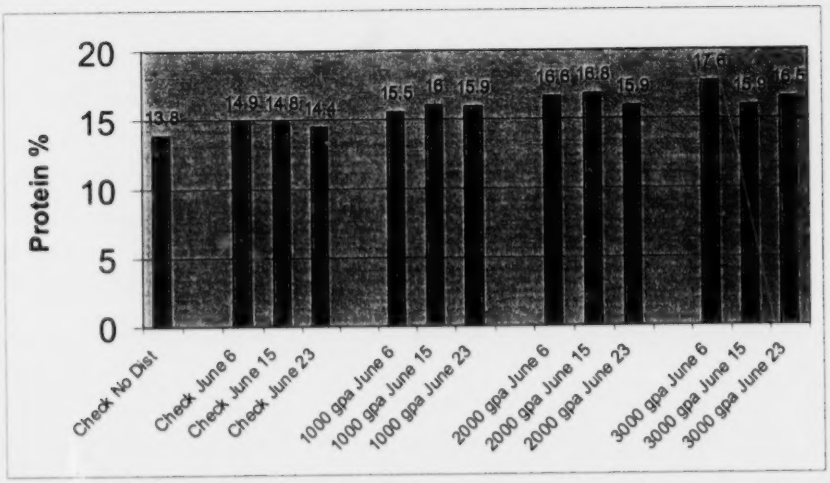


Figure 6. Effect of Post Emergent Injection of Swine Manure on Wheat Protein – Site 2, Summer 2000.

Tissue N concentration was lower at Site 1 (Troop site) than Site 2 (Henning site) in check plots. This is consistent with both yield and protein response at Site 1, but only protein increases at Site 2, which is consistent with overall higher yields in the check and greater Tissue N. Therefore, N was not as limiting at Site 2. Highest protein and yield of greater than 3,696 kg/ha (55 bu/ac) and 16% protein were obtained at Site 2 with 22,647 L/ha (2,000 gpa) and 33,700 L/ha (3,000 gpa) applied June 6.

2.3.2 2001 Results

In the 2001 crop year Leroy Site 2 yielded better than Leroy Site 1. Time of application has a significant effect on yield with later application associated with lower yields, presumably due to greater crop damage at later dates (**Figures 7** and **8**).

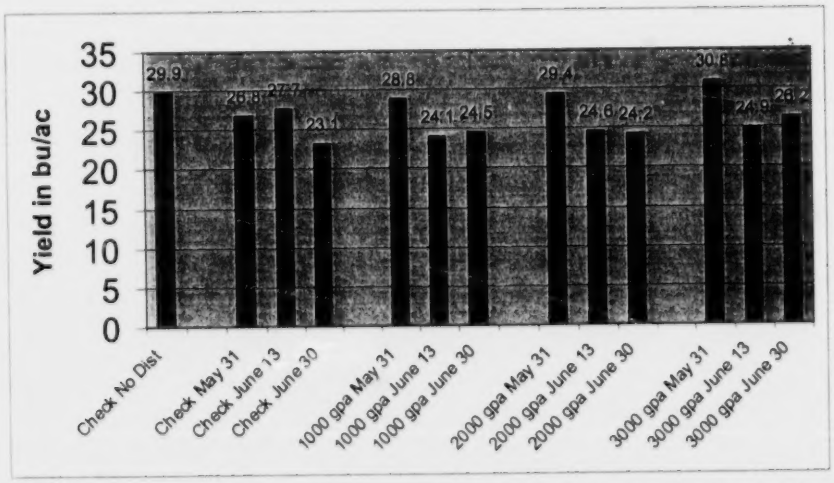


Figure 7. Effect of Post Emergent Injection of Swine Manure on Wheat Yield – Site 1, Summer 2001.

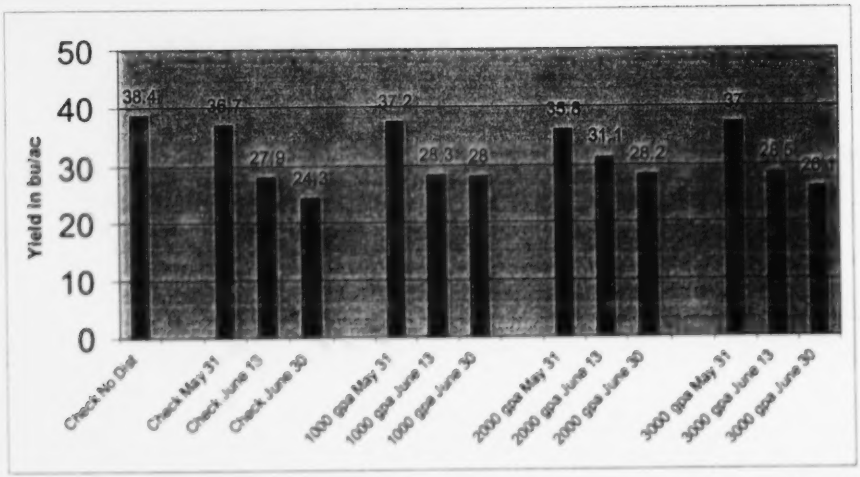


Figure 8. Effect of Post Emergent Injection of Swine Manure on Wheat Yield – Site 2, Summer 2001.

Compared to the disturbed check for each time interval, manure application at 11,233, 22,647, and 33,70 L/ha (1,000, 2,000, and 3,000 gpa) did not produce significant yield increases. Yields were all around 2,554 kg/ha (38 bu/ac) for control and manure treatments at Leroy 2 for May 31 application, 2,083 kg/ha (31 bu/ac) for treatments on June 13, and 1,814 kg/ha (27 bu/ac) for treatments on June 27. Both fields (Leroy 1 and 2) had good N fertility to start with and given the dry conditions did not respond with increased yield. Tissue N concentrations revealed the good N fertility status of the fields, with about 5% N concentration. With this high N concentration in the tissue indicating good N fertility, large yield response to additional N applied post emergent is not expected. In the third year, a concerted effort will be made to select a field with low N fertility to begin with.

Protein content was increased by about one percentage point from the control (17%) to 22,647 L/ha (2,000 gpa) (18%), with no further protein gains from 22,647 to 33,700 L/ha (2,000 to 3,000 gpa) (**Figures 9** and **10**).

In 2001, injection disturbance after the end of May (June 13 and June 27 dates) was responsible for a large and significant reduction in yield, 672 to 1,008 kg/ha (10 to 15 bu/ac). Overall in 2001, post emergent application after the end of May would have a negative economic effect because of the yield reductions associated with the disturbance itself, even though there was still a gain in protein. This is in contrast to the observations in 2000 where the disturbance itself has a positive effect on yield.

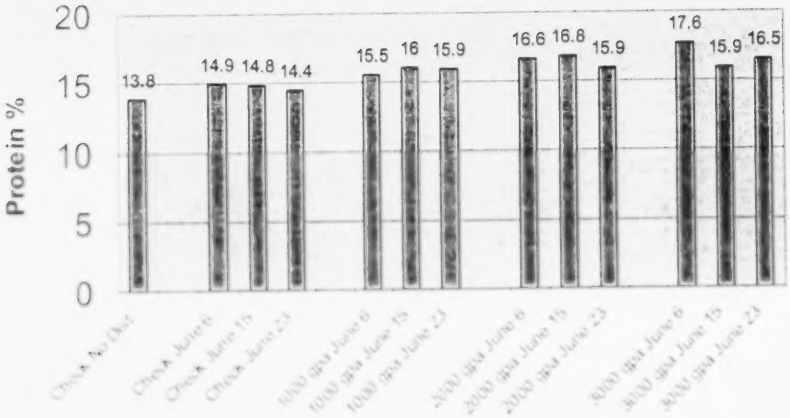


Figure 6. Effect of Post Emergent Injection of Swine Manure on Wheat Protein – Site 2, Summer 2000.

Tissue N concentration was lower at Site 1 (Troop site) than Site 2 (Henning site) in check plots. This is consistent with both yield and protein response at Site 1, but only protein increases at Site 2, which is consistent with overall higher yields in the check and greater Tissue N. Therefore, N was not as limiting at Site 2. Highest protein and yield of greater than 3,696 kg/ha (55 bu/ac) and 16% protein were obtained at Site 2 with 22,647 L/ha (2,000 gpa) and 33,700 L/ha (3,000 gpa) applied June 6.

2.3.2 2001 Results

In the 2001 crop year Leroy Site 2 yielded better than Leroy Site 1. Time of application has a significant effect on yield with later application associated with lower yields, presumably due to greater crop damage at later dates (**Figures 7** and **8**).

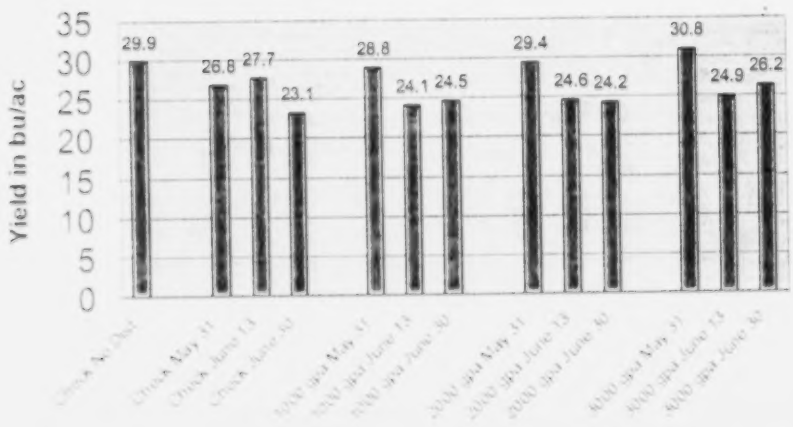


Figure 7. Effect of Post Emergent Injection of Swine Manure on Wheat Yield – Site 1, Summer 2001

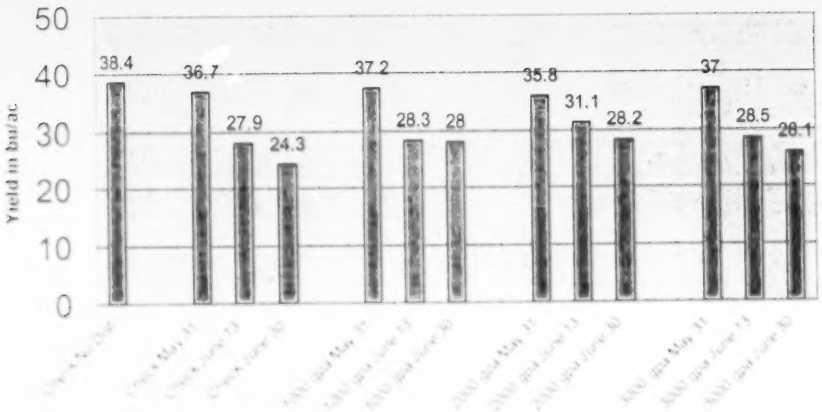


Figure 8. Effect of Post Emergent Injection of Swine Manure on Wheat Yield – Site 2, Summer 2001.

Compared to the disturbed check for each time interval, manure application at 11,233, 22,647, and 33,70 L/ha (1,000, 2,000, and 3,000 gpa) did not produce significant yield increases. Yields were all around 2,554 kg/ha (38 bu/ac) for control and manure treatments at Leroy 2 for May 31 application, 2,083 kg/ha (31 bu/ac) for treatments on June 13, and 1,814 kg/ha (27 bu/ac) for treatments on June 27. Both fields (Leroy 1 and 2) had good N fertility to start with and given the dry conditions did not respond with increased yield. Tissue N concentrations revealed the good N fertility status of the fields, with about 5% N concentration. With this high N concentration in the tissue indicating good N fertility, large yield response to additional N applied post emergent is not expected. In the third year, a concerted effort will be made to select a field with low N fertility to begin with.

Protein content was increased by about one percentage point from the control (17%) to 22,647 L/ha (2,000 gpa) (18%), with no further protein gains from 22,647 to 33,700 L/ha (2,000 to 3,000 gpa) (**Figures 9** and **10**).

In 2001, injection disturbance after the end of May (June 13 and June 27 dates) was responsible for a large and significant reduction in yield, 672 to 1,008 kg/ha (10 to 15 bu/ac). Overall in 2001, post emergent application after the end of May would have a negative economic effect because of the yield reductions associated with the disturbance itself, even though there was still a gain in protein. This is in contrast to the observations in 2000 where the disturbance itself has a positive effect on yield.

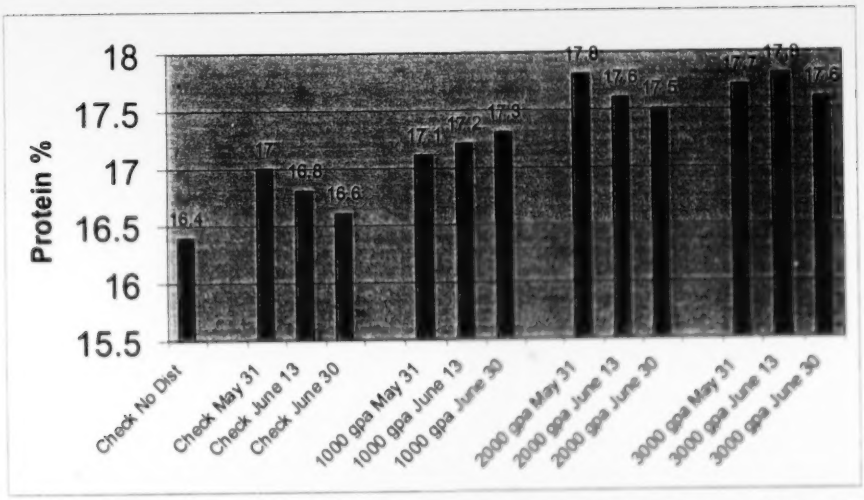


Figure 9. Effect of Post Emergent Injection of Swine Manure on Wheat Protein – Site 1, Summer 2001.

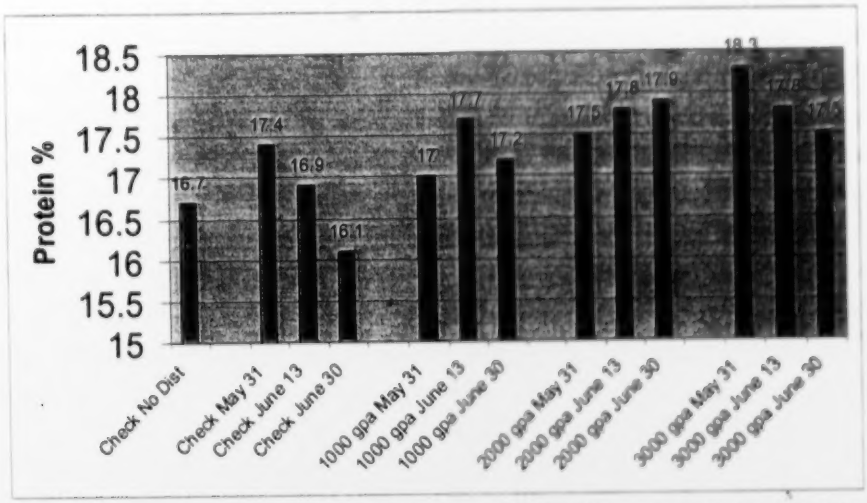


Figure 10. Effect of Post Emergent Injection of Swine Manure on Wheat Protein – Site 2, Summer 2001.

2.3.3 2002 Results

Site 1 yielded higher than Site 2, which may be attributed to better stored soil moisture since Site 1 was summerfallow. Early (June 7) application produced higher yields than later applications (June 21 and July 4). The last application date in particular, July 4, was associated with yield reduction. There was not much difference in yield between June 7 and June 21 application dates. The late disturbance (July 4) alone produced significantly lower yield, indicating that the disturbance itself was having a negative impact, possibly due to stand injury and/or drying out of the surface. This was observed at both sites (**Figures 11** and **12**).

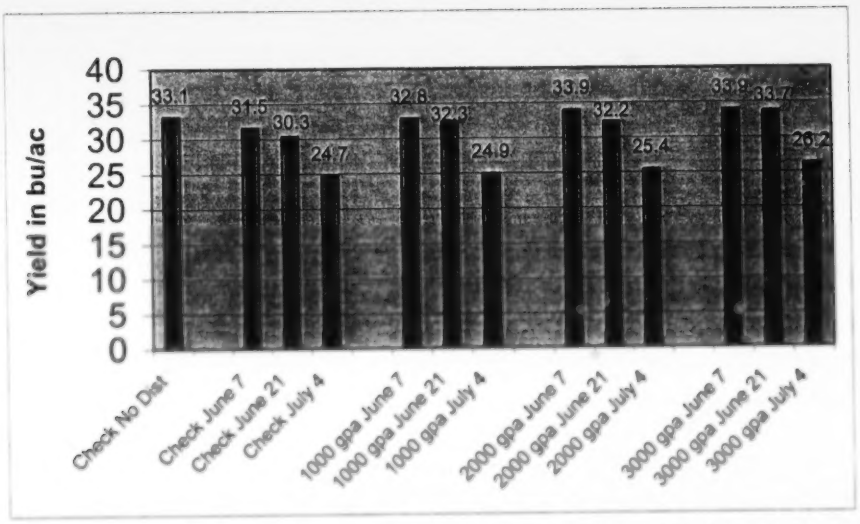


Figure 11. Effect of Post Emergent Manure Injection on Wheat Yield – Site 1 – 2002.

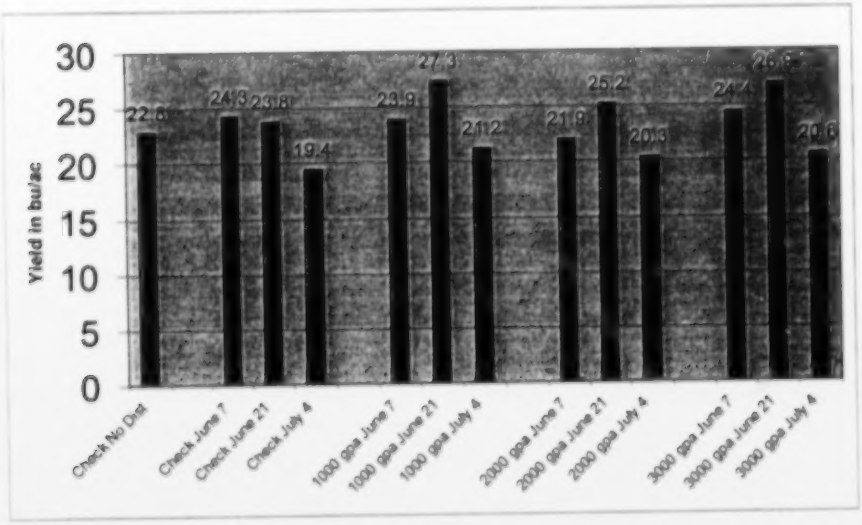


Figure 12. Effect of Post Emergent Swine Manure Injection on Wheat Yield – Site 2 – 2002.

The early date of application (June 7) produced some significant yield responses over the undisturbed check at Site 2. This was also observed for the June 21 application. Yield responses at Site 2, but not at Site 1 could be related to the stage of the crop in relation to time of injection. For the late application, (July 4), at which time the crop was in the flag leaf stage, the damage produced from the disturbance could not be offset by the manure. The yields were lower than the undistributed check for manure applied July 5 at both sites, so that this treatment would have a negative economic return. It would appear to obtain maximum benefit from post emergent injection of swine manure into cereal crops, the best yield responses should occur from early application into nitrogen deficient soils. Good growing conditions (ample moisture) are associated with the best

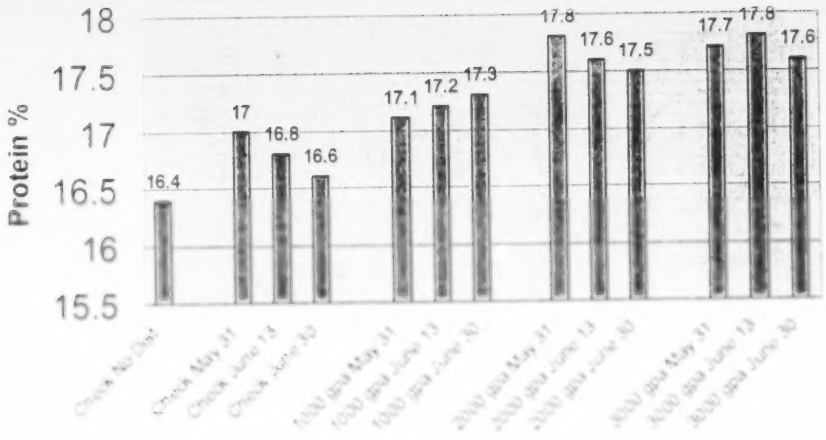


Figure 9. Effect of Post Emergent Injection of Swine Manure on Wheat Protein – Site 1. Summer 2001.

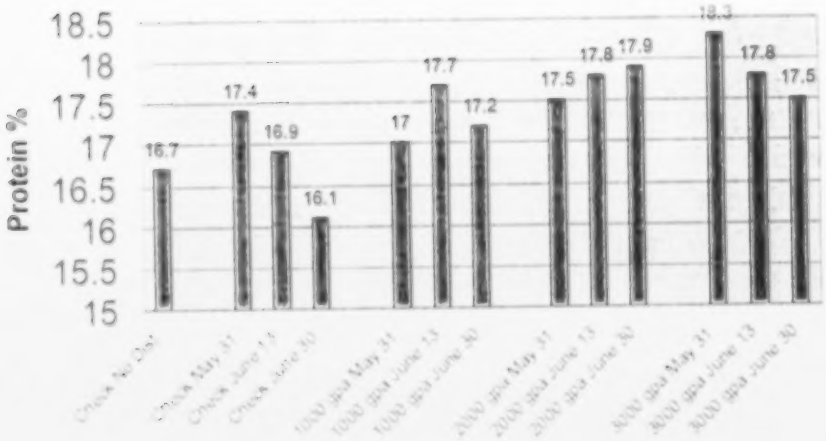


Figure 10. Effect of Post Emergent Injection of Swine Manure on Wheat Protein – Site 2. Summer 2001.

2.3.3 2002 Results

Site 1 yielded higher than Site 2, which may be attributed to better stored soil moisture since Site 1 was summerfallow. Early (June 7) application produced higher yields than later applications (June 21 and July 4). The last application date in particular, July 4, was associated with yield reduction. There was not much difference in yield between June 7 and June 21 application dates. The late disturbance (July 4) alone produced significantly lower yield, indicating that the disturbance itself was having a negative impact, possibly due to stand injury and/or drying out of the surface. This was observed at both sites (**Figures 11** and **12**).

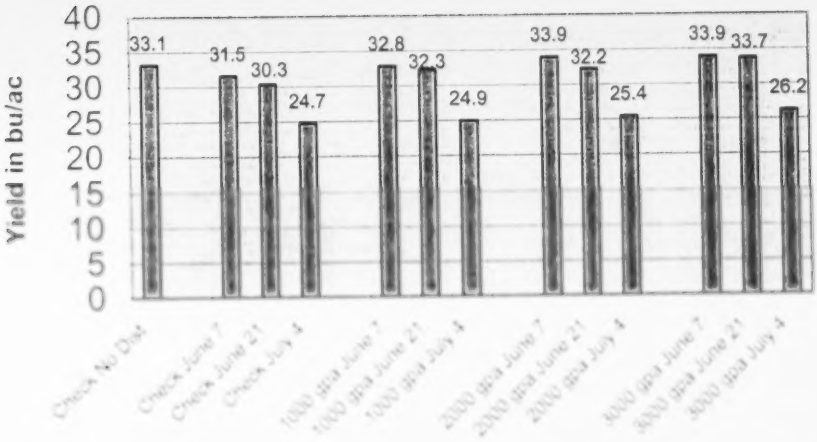


Figure 11. Effect of Post Emergent Manure Injection on Wheat Yield – Site 1 – 2002

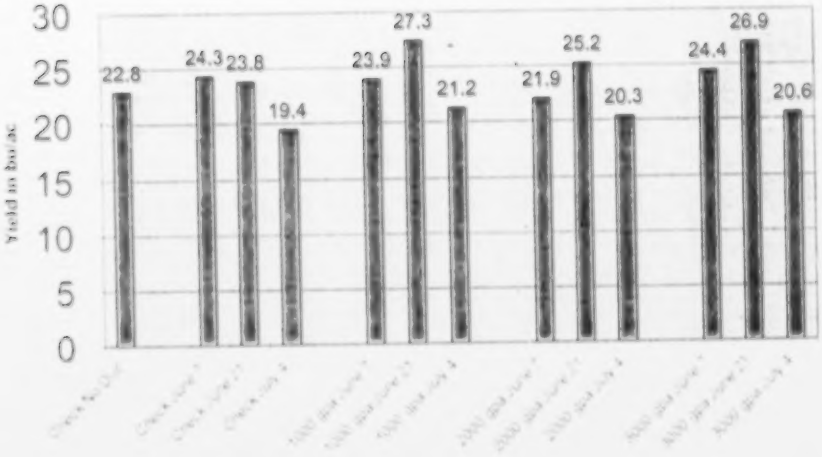


Figure 12. Effect of Post Emergent Swine Manure Injection on Wheat Yield – Site 2 – 2002

The early date of application (June 7) produced some significant yield responses over the undisturbed check at Site 2. This was also observed for the June 21 application. Yield responses at Site 2, but not at Site 1 could be related to the stage of the crop in relation to time of injection. For the late application, (July 4), at which time the crop was in the flag leaf stage, the damage produced from the disturbance could not be offset by the manure. The yields were lower than the undistributed check for manure applied July 6 at both sites, so that this treatment would have a negative economic return. It would appear to obtain maximum benefit from post emergent injection of swine manure into cereal crops, the best yield responses should occur from early application into nitrogen deficient soils. Good growing conditions (ample moisture) are associated with the best

chance of positive response, as indicated by good responses in yield and protein in 2000 (normal year), but reduced yield response negative response in the dry years of 2001 and 2002.

Later application date (July 4) resulted in slightly higher protein than earlier application. This may be attributed to the yield reduction associated with the late application date. The post emergent injection of swine manure increased protein content at both sites by about 0.7 points from the control to the high rate 33,700 L/ha (3,000 gpa). However, the increase in protein content is not large and the economic benefit from protein premium would not likely offset the impact of reduced yield associated with the late application dates, **Figures 13** and **14**.

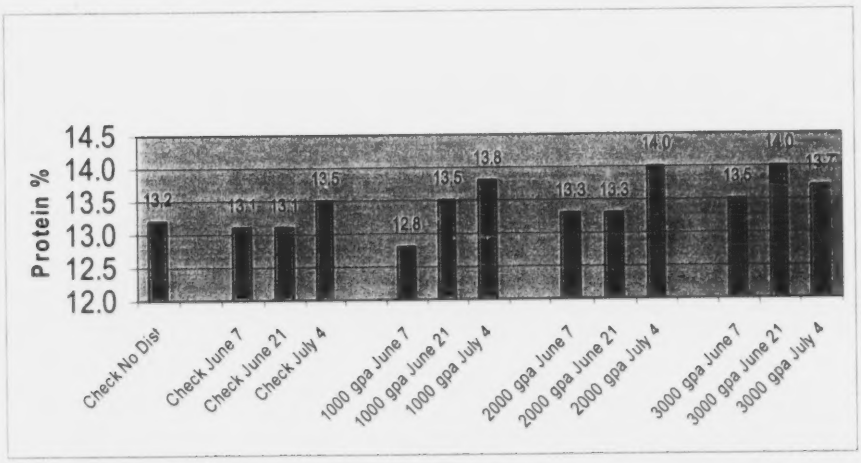


Figure 13. Effect of Post Emergent Manure Injection on Grain Protein – Site 1 – 2002.

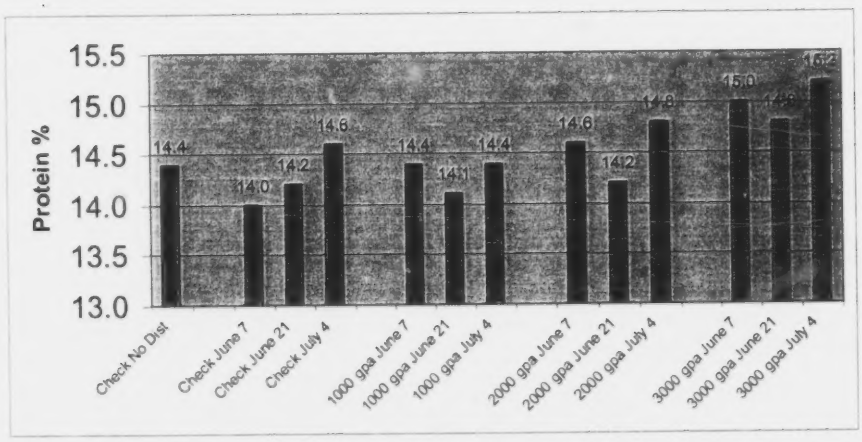


Figure 14. Effect of Post Emergent Swine Manure Injection on Grain Protein – Site 2 – 2002.

As protein benefits were observed with the early as well as the late application times, particularly at Site 2, and it was with the early application times that there was no yield response (Site 1) or a positive yield (Site 2), an early application at a rate between 11,233 and 33,700 L/ha (1,000 to 3,000 gpa) would be recommended.

2.3.4 2003 Results

Rainfall in April 2003 was more than three times normal precipitation followed by near normal precipitation in May and June and below normal precipitation in July and August. July and August were also hot with above normal temperatures.

Overall there was little effect of post emergent manure application on wheat yield (**Figure 15**).

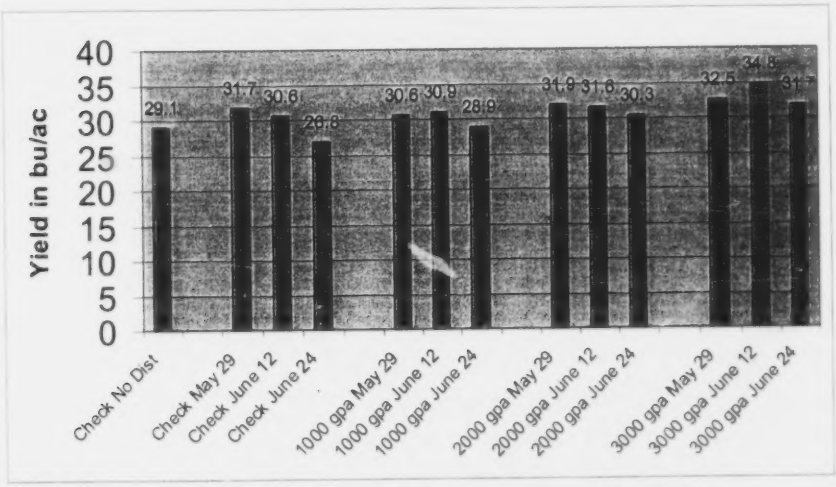


Figure 15. Effect of Post Emergent Injection on Wheat Yield 2003.

Increases in protein content due to manure application were highly significant in 2003 with increased protein content as manure application increased. Compared to the undisturbed check, grain protein increased by 1.9% at the 11,223 L/ha (1,000 gpa) rate, 2.6% at the 22,647 L/ha (2,000 gpa) rate, and 3.1% at the 33,700 L/ha (3,000 gpa) rate (**Figure 16**).

chance of positive response, as indicated by good responses in yield and protein in 2000 (normal year), but reduced yield response negative response in the dry years of 2001 and 2002.

Later application date (July 4) resulted in slightly higher protein than earlier application. This may be attributed to the yield reduction associated with the late application date. The post emergent injection of swine manure increased protein content at both sites by about 0.7 points from the control to the high rate 33,700 L/ha (3,000 gpa). However, the increase in protein content is not large and the economic benefit from protein premium would not likely offset the impact of reduced yield associated with the late application dates. **Figures 13** and **14**.

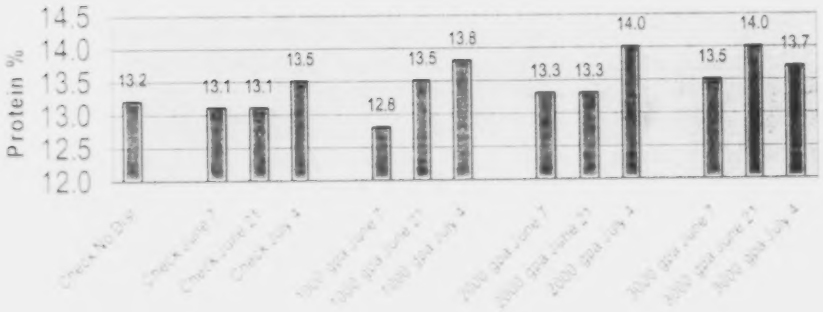


Figure 13. Effect of Post Emergent Manure Injection on Grain Protein – Site 1 – 2002.

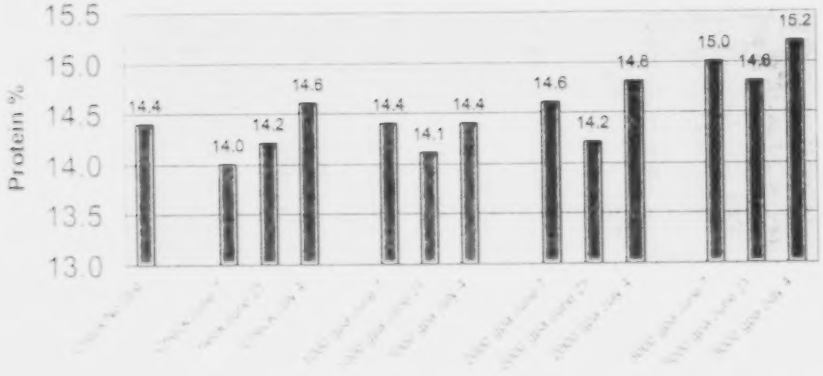


Figure 14. Effect of Post Emergent Swine Manure Injection on Grain Protein – Site 2 – 2002.

As protein benefits were observed with the early as well as the late application times, particularly at Site 2, and it was with the early application times that there was no yield response (Site 1) or a positive yield (Site 2), an early application at a rate between 11,233 and 33,700 L/ha (1,000 to 3,000 gpa) would be recommended.

2.3.4 2003 Results

Rainfall in April 2003 was more than three times normal precipitation followed by near normal precipitation in May and June and below normal precipitation in July and August. July and August were also hot with above normal temperatures.

Overall there was little effect of post emergent manure application on wheat yield (**Figure 15**).

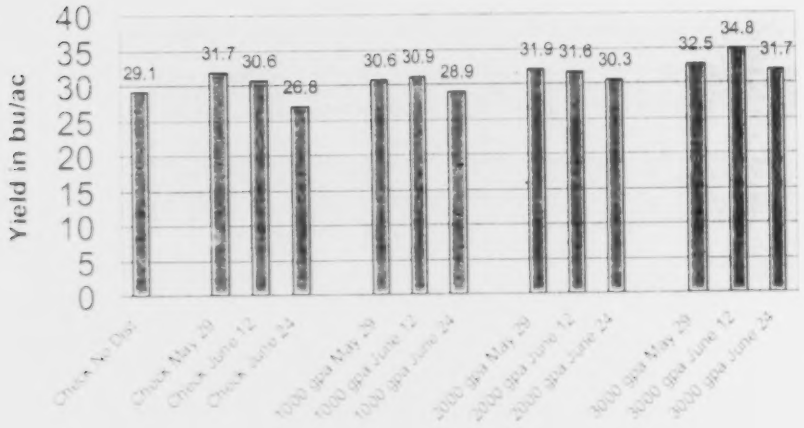


Figure 15 Effect of Post Emergent Injection on Wheat Yield 2003.

Increases in protein content due to manure application were highly significant in 2003 with increased protein content as manure application increased. Compared to the undisturbed check, grain protein increased by 1.9% at the 11,223 L/ha (1,000 gpa) rate, 2.6% at the 22,647 L/ha (2,000 gpa) rate, and 3.1% at the 33,700 L/ha (3,000 gpa) rate (**Figure 16**).

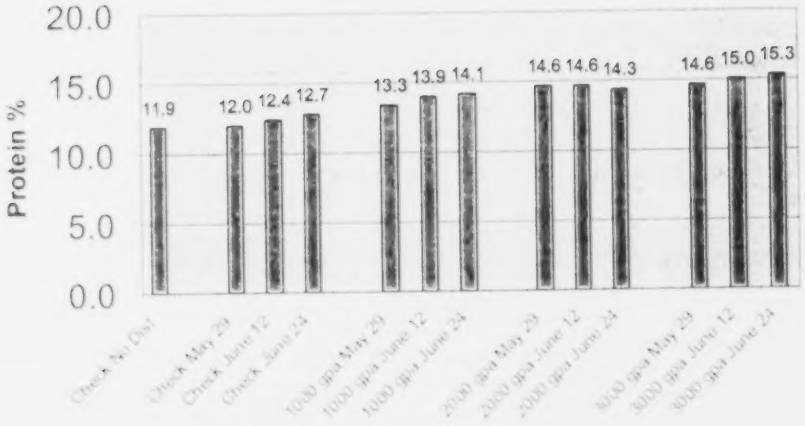


Figure 16. Effects of Post Emergent Manure Injection on Grain Protein 2003.

2.3.5 Combined Results

Yield varied greatly among years, reflecting differences in spring soil water reserves and growing season rainfall.

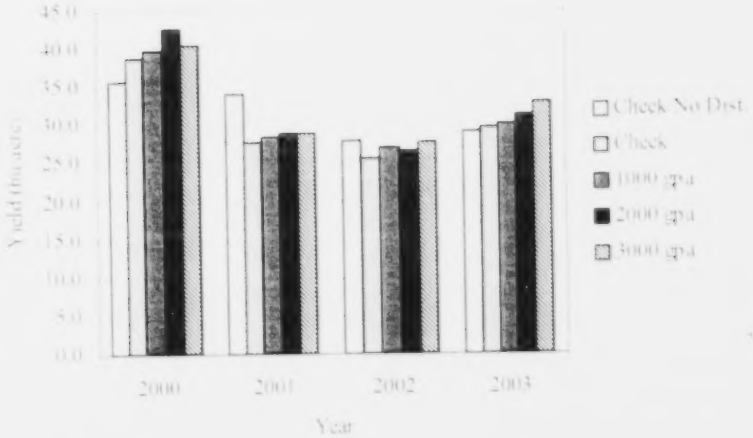


Figure 17. Yield Data 2000 – 2003.

Yield benefits from manure application occurred in 2000 and 2003 but not in 2001 and 2002.

Protein concentration increased significantly from manure application in 2000, 2001, and 2003 but not in 2002 (**Figure 18**).

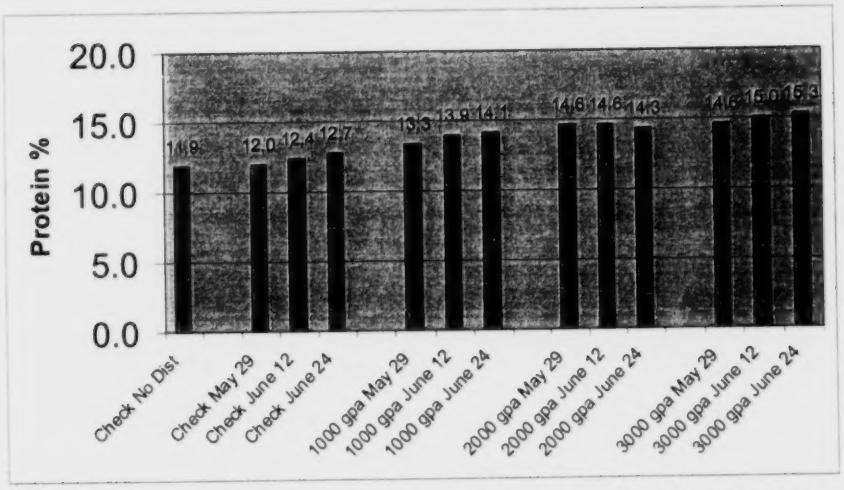


Figure 16. Effects of Post Emergent Manure Injection on Grain Protein 2003.

2.3.5 Combined Results

Yield varied greatly among years, reflecting differences in spring soil water reserves and growing season rainfall.

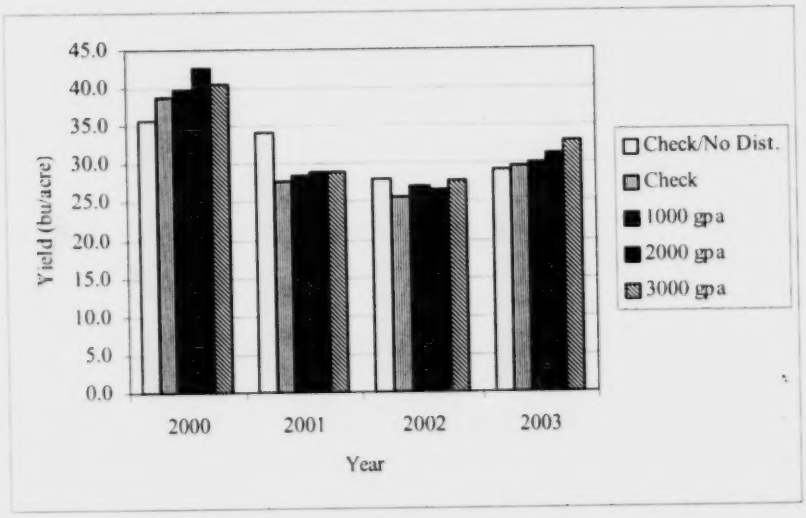


Figure 17. Yield Data 2000 – 2003.

Yield benefits from manure application occurred in 2000 and 2003 but not in 2001 and 2002.

Protein concentration increased significantly from manure application in 2000, 2001, and 2003 but not in 2002 (**Figure 18**).

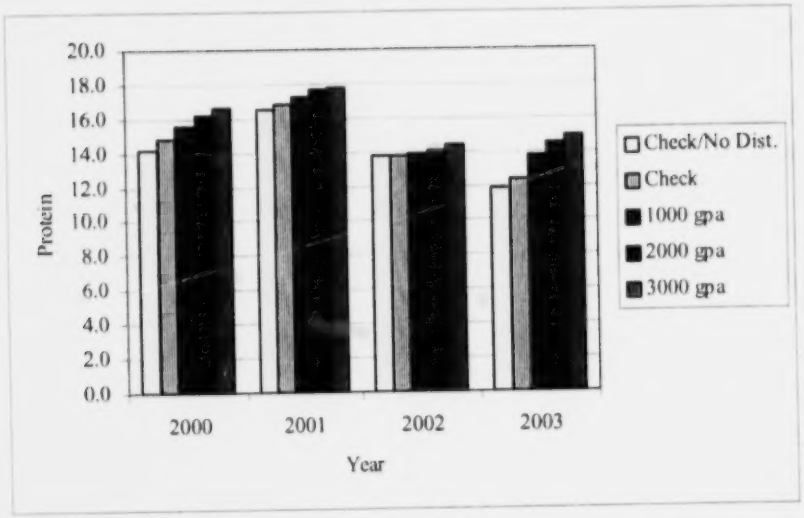


Figure 18. Grain Protein Concentration 2000-2003.

Overall there was a linear protein response with rate of manure application.

Although it was not measured, wheel track damage to the crop from late manure application was observed at most sites in most years.

2.4 Conclusions

Post emergent manure application is an effective means of boosting protein and will also increase yields in years of adequate rainfall and moisture reserves. The later manure application dates resulted in wheel track crop damage, which may offset the benefits of manure application. In dry years, post emergent manure application, especially at later application dates, may cause serious crop damage resulting in yield and income loss.

5. Equipment

No equipment was purchased for this project.

6. Project Materials

No project materials have been developed at this time except for plot signage. A field tour of manure research sites was held on June 23, and a field day on August 2 also included a tour of the sites.

7. Project Photos

Figure 19. June 6, 2000, Site 1. Injection Parallel to Seed Rows Showing Soil Disturbance.

Figure 20. June 6, 2000, Site 1. Injection Parallel to Seed Rows Showing Soil Disturbance at Higher Speed.

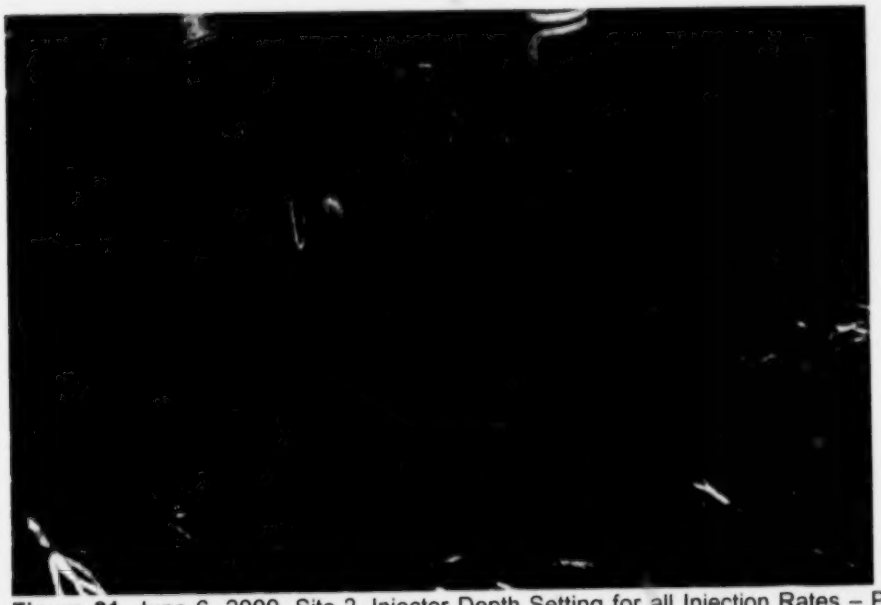


Figure 21. June 6, 2000, Site 2. Injector Depth Setting for all Injection Rates – Perpendicular to Seed Rows.

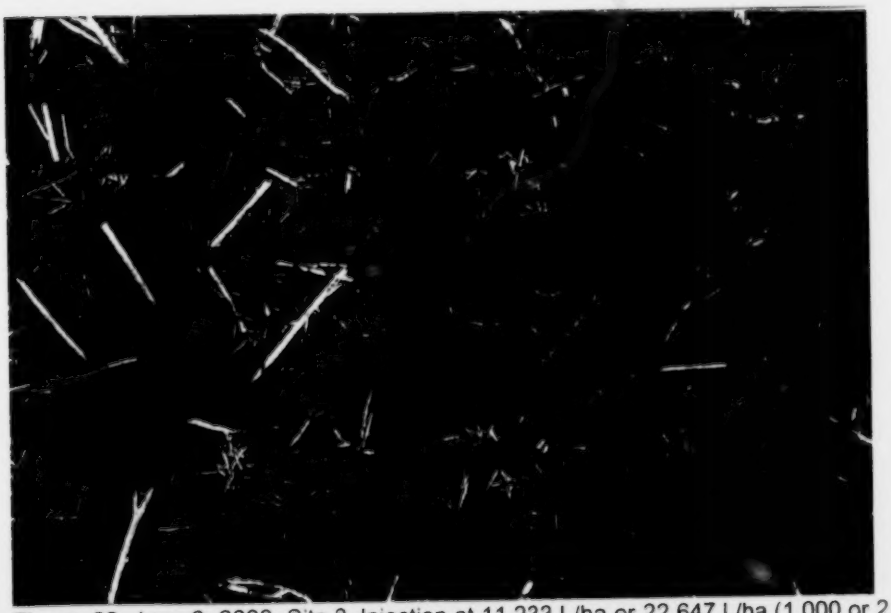


Figure 22. June 6, 2000, Site 2. Injection at 11,233 L/ha or 22,647 L/ha (1,000 or 2,000 gpa) Rate with Full Manure Coverage and Typical Soil Disturbance.

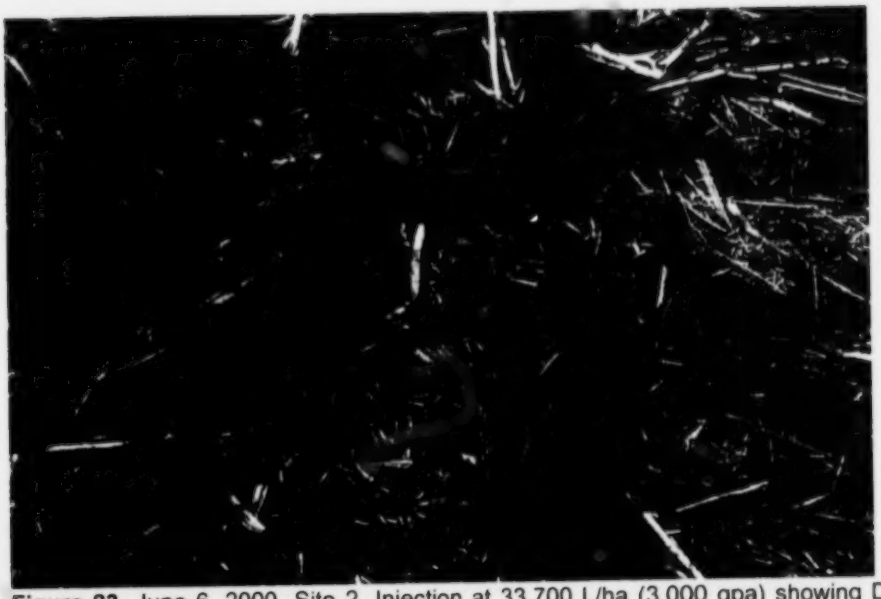


Figure 23. June 6, 2000, Site 2. Injection at 33,700 L/ha (3,000 gpa) showing Disturbance and Some Surface Liquid.

Figure 24. June 15, 2000, Site 1. Injection at 11,233 L/ha (1,000 gpa).

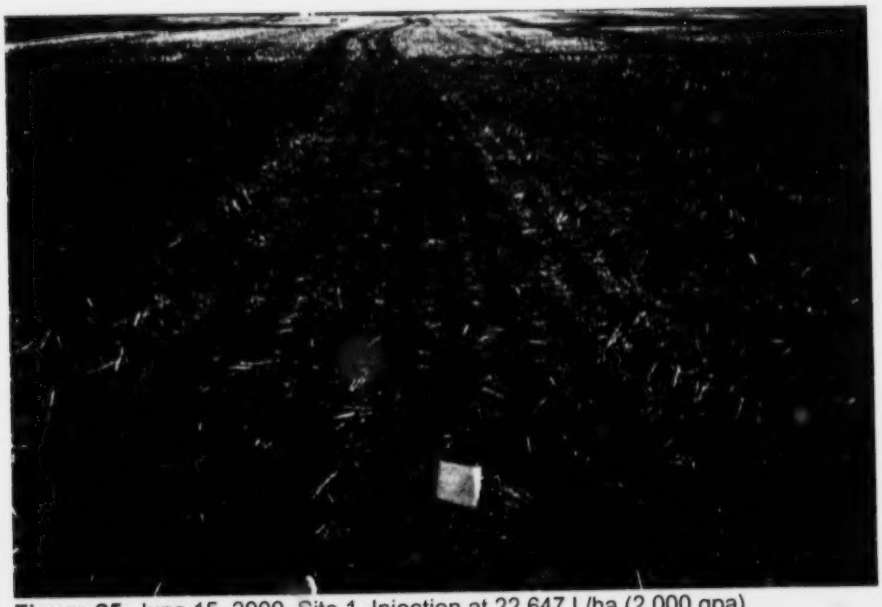


Figure 25. June 15, 2000, Site 1. Injection at 22,647 L/ha (2,000 gpa).

Figure 26. June 15, 2000, Site 1. Injection at 33,700 L/ha (3,000 gpa).

Figure 27. June 15, 2000, Site 2. Injection at 11,233 L/ha (1,000 gpa).

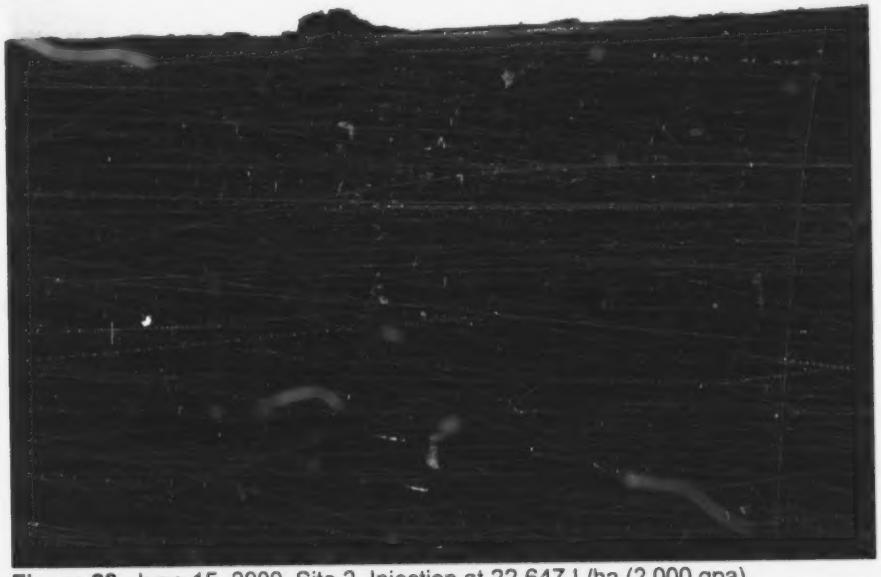


Figure 28. June 15, 2000, Site 2. Injection at 22,647 L/ha (2,000 gpa).

Figure 29. June 15, 2000, Site 2. Injection at 33,700 L/ha (3,000 gpa).

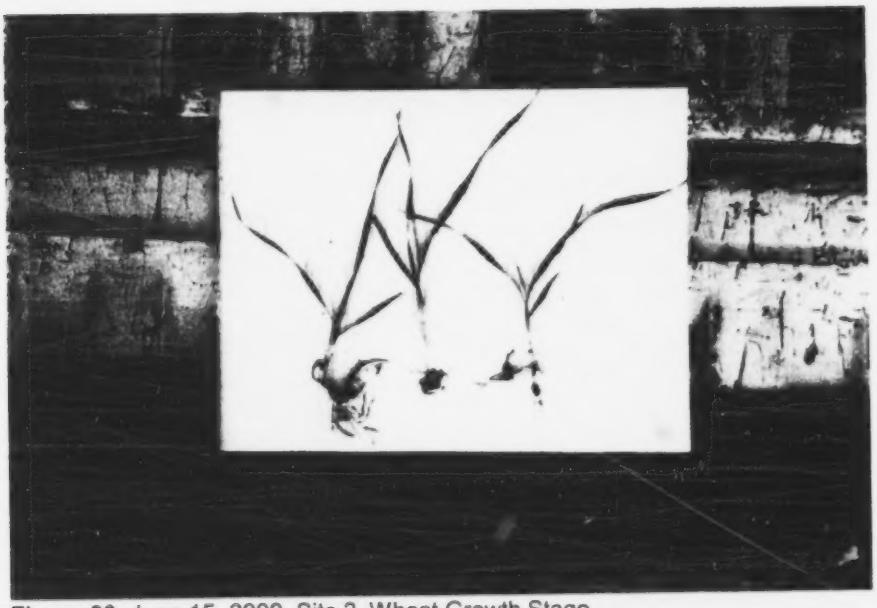


Figure 30. June 15, 2000, Site 2. Wheat Growth Stage.

Figure 31. June 15, 2000, Site 2. Close-up Showing Crop Disturbance Perpendicular to Row.

Figure 32. June 23, 2000, Site 2. Injection perpendicular to Seed Rows.

Figure 33. June 23, 2000, Site 2. Close-up of Disturbance and Crop Damage.

Figure 34. June 23, 2000. Field Day Tour Group at Grassland Site.

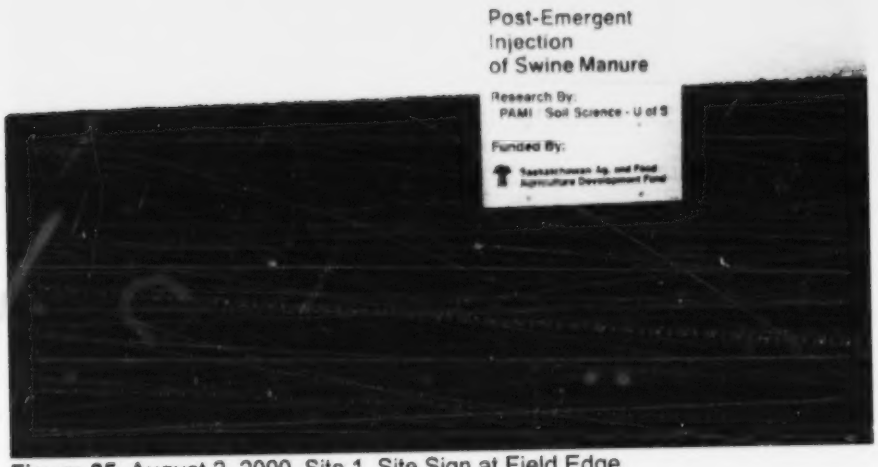


Figure 35. August 2, 2000, Site 1. Site Sign at Field Edge.

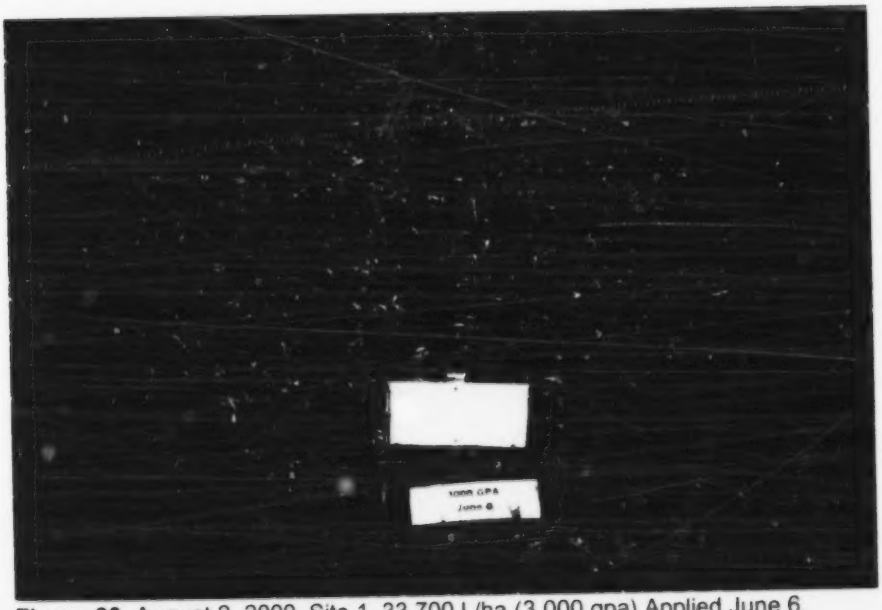


Figure 36. August 2, 2000, Site 1. 33,700 L/ha (3,000 gpa) Applied June 6.

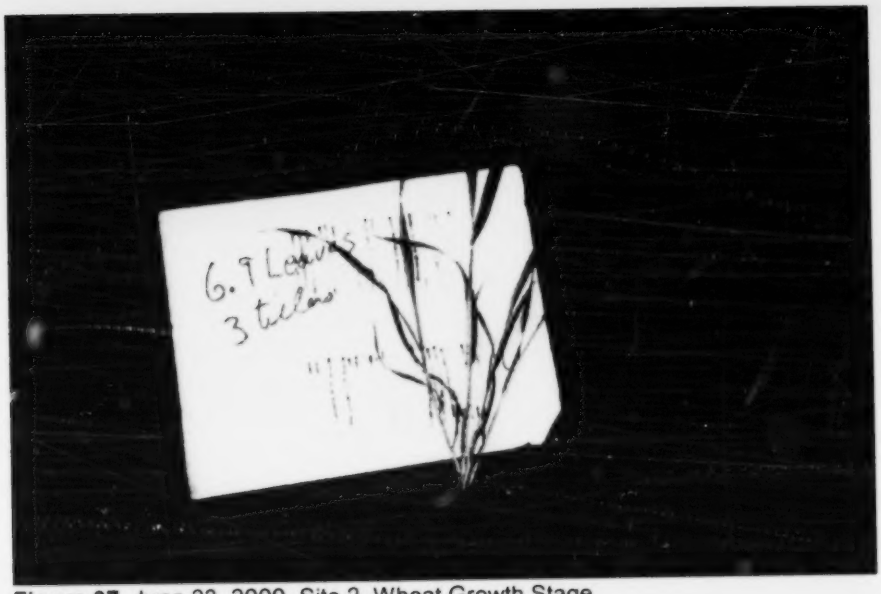


Figure 37. June 23, 2000, Site 2. Wheat Growth Stage.

Figure 38. May 31, 2001, Site 1. Injection with PAMI Low Disturbance Manure Injection Truck.

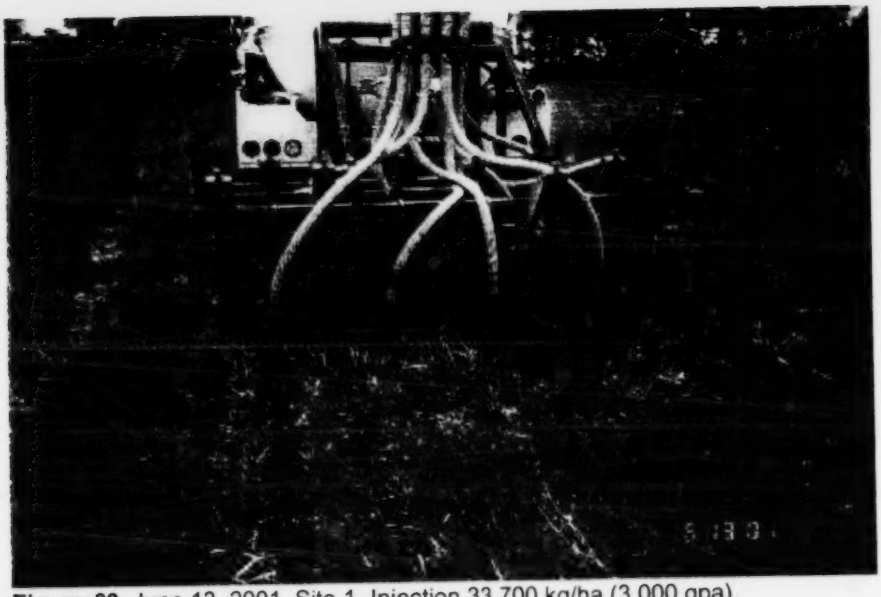


Figure 39. June 13, 2001, Site 1. Injection 33,700 kg/ha (3,000 gpa).

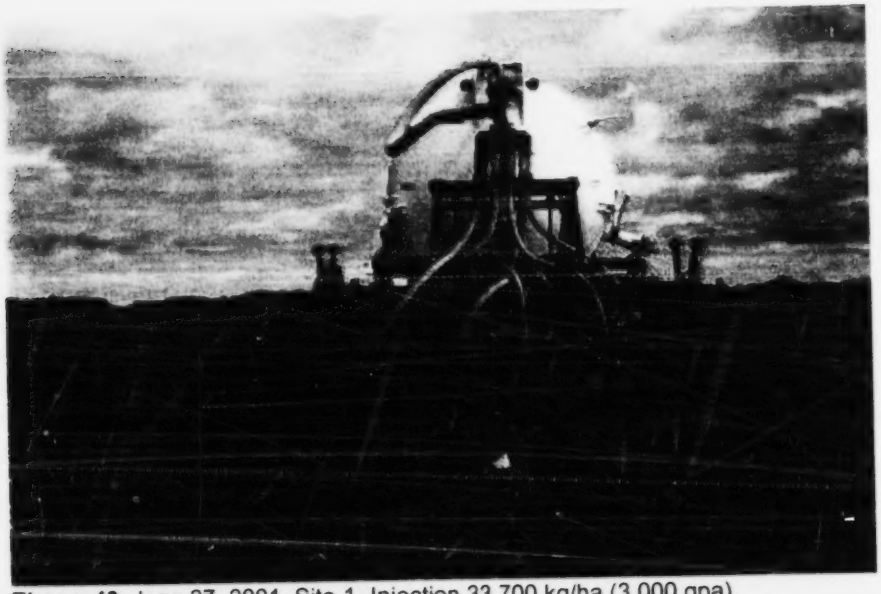


Figure 40. June 27, 2001, Site 1. Injection 33,700 kg/ha (3,000 gpa).

Figure 41. May 31, 2001, Site 2. Injection 33,700 L/ha (3,000 gpa).

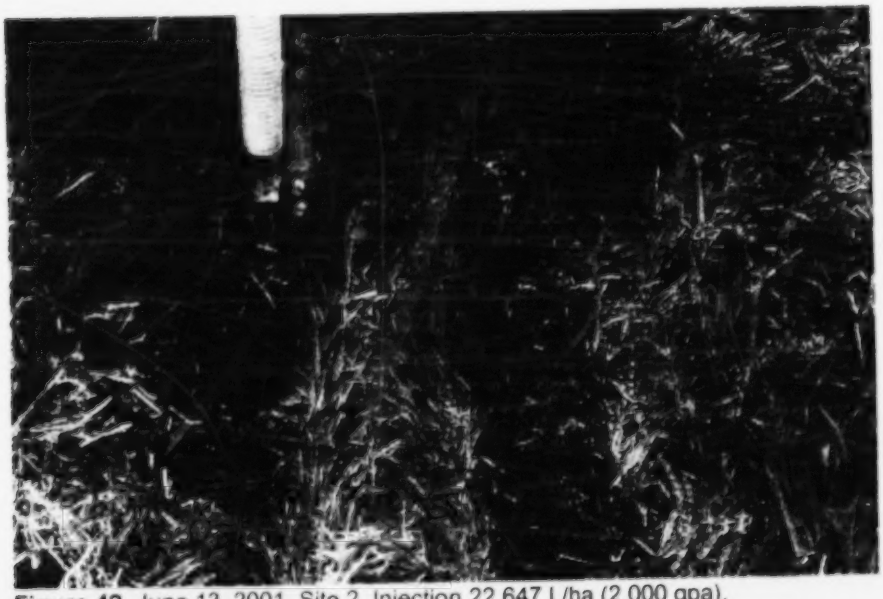


Figure 42. June 13, 2001, Site 2. Injection 22,647 L/ha (2,000 gpa).

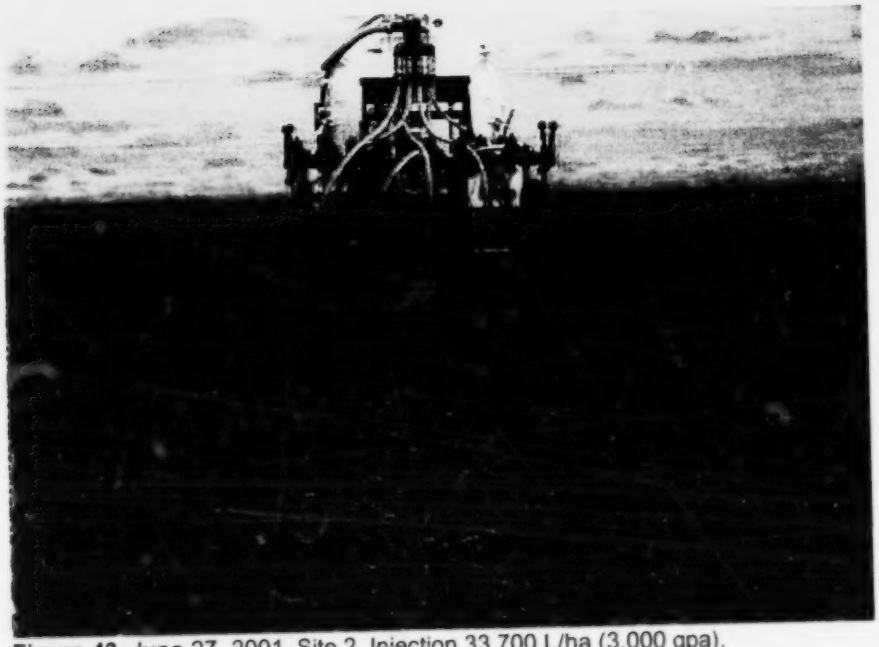


Figure 43. June 27, 2001, Site 2. Injection 33,700 L/ha (3,000 gpa).

Figure 44. August 8, 2001, Site 2. Effects of Wheel Tracks Causing Delayed Maturity.

Figure 45. 2001 Harvest.

8. Acknowledgement

Tours of the research work were conducted as part of local research work tour organized by Saskatchewan Agriculture and Food.

APPENDIX I

Appendix I

2000 Project Data

Concentrations in *Hog Manure* Applied at Leroy Post Emergent June 6 2000

Tot. N	NH4	NO3	Tot. P	Avail P	K	Ca	Mg	Cu	Fe	Mn	Zn	B	Na
ug/ml													
2788	2121	-	137	62	1237	380	33	2.3	7.2	1.9	7.3	2.3	940

Application rates of nutrient in kg/ha

Rate gpa														
1000	32	24	-	1.6	0.7	14	4.3	0.4	0.02	0.08	0.02	0.08	0.02	10.7

Concentrations in *Hog Manure* Applied at Leroy Post Emergent June 15 2000

Tot. N	NH4	NO3	Tot. P	Avail P	K	Ca	Mg	Cu	Fe	Mn	Zn	B	Na
ug/ml													
2689	1866	-	136	53	1247	284	33	1.9	7.7	1.5	8.9	2.3	933

Application rates of nutrient in kg/ha

Rate gpa														
1000	31	21	-	1.6	0.6	14.2	3.2	0.4	0.02	0.09	0.02	0.10	0.03	10.6

Concentrations in *Hog Manure* Applied at Leroy Post Emergent June 23 2000

	Tot. N	NH4	NO3	Tot. P	Avail P	K	Ca	Mg	Cu	Fe	Mn	Zn	B	Na
	ug/ml													
	2674	1963	-	184	58	1351	380	69	2.2	9.0	2.6	5.5	2.0	966
	Application rates of nutrient in kg/ha													
Rate gpa														
1000	30	22	-	2.1	0.7	15	4.3	0.8	0.03	0.10	0.03	0.06	0.02	11.0

Post Emergent Manure on Wheat or Barley
Grain Yield Site #1

	Plot Grain Wt in Kg						
Treatment	**R1**	**R2**	**R3**	**R4**	**Total**	**Kg/ha**	**bu/ac**
1. Check	4.76	6.36	7.80	7.14	26.06	1771	26.3
2. Check disturbed June 1	4.00	6.00	7.96	4.68	22.64	1538	22.9
3. 1000 GPA June 1	5.48	6.26	6.76	8.60	27.10	1841	27.4
4. 2000 GPA June 1	5.70	9.34	7.84	6.72	29.60	2011	29.9
5. 3000 GPA June 1	4.64	6.04	8.44	6.02	25.14	1708	25.4
6. Check disturbed June 15	7.02	6.28	6.94	7.92	28.16	1913	28.5
7. 1000 GPA June 15	5.22	4.72	8.14	8.56	26.64	1810	26.9
8. 2000 GPA June 15	8.56	5.80	7.82	7.72	29.90	2032	30.2
9. 3000 GPA June 15	8.26	6.94	9.40	11.36	35.96	2443	36.3
10. Check disturberd June 30	5.64	7.66	8.50	6.62	28.42	1931	28.7
11. 1000 GPA June 30	7.44	7.28	4.88	8.78	28.38	1928	28.7
12. 2000 GPA June 30	6.20	5.66	6.64	6.40	24.90	1692	25.2
13. 3000 GPA June 30	7.76	7.84	9.68	6.60	31.88	2166	32.2
	6.21	6.63	7.75	7.47	28.06		

Post Emergent Manure on Wheat or Barley
Grain Yield Site #2

	Plot Grain Wt in Kg						
Treatment	**R1**	**R2**	**R3**	**R4**	**Total**	**Kg/ha**	**bu/ac**
1. Check	4.92	5.42	5.78	6.22	22.34	3035	45.1
2. Check disturbed June 1	5.70	6.06	5.60	6.58	23.94	3253	48.4
3. 1000 GPA June 1	6.22	6.20	6.32	6.66	25.40	3451	51.3
4. 2000 GPA June 1	6.14	5.60	6.26	6.64	24.64	3348	49.8
5. 3000 GPA June 1	5.18	6.30	6.48	6.58	24.54	3334	49.6
6. Check disturbed June 15	6.60	6.30	6.62	6.32	25.84	3511	52.2
7. 1000 GPA June 15	6.46	6.26	6.14	7.05	25.91	3520	52.3
8. 2000 GPA June 15	6.34	6.14	6.10	6.80	25.38	3448	51.3
9. 3000 GPA June 15	6.44	6.40	6.56	6.88	26.28	3571	53.1
10. Check disturberd June 30	6.62	6.82	5.78	6.42	25.64	3484	51.8
11. 1000 GPA June 30	7.24	6.40	4.88	7.00	25.52	3467	51.6
12. 2000 GPA June 30	7.42	7.12	7.06	7.20	28.80	3913	58.2
13. 3000 GPA June 30	7.62	6.76	6.34	7.40	28.12	3821	56.8
	6.38	6.29	6.15	6.75	25.57		

2000: Dr. Jeff Schoenau's Post Emergent Hog Manure Project at Humboldt

Coordinated by Dr. S.P. Mooleki **2000 Wheat crop.** *January 8, 2001*

This file: C:\My Documents\Jeff\2000work\Data2000\Crop\00CRPEmHogAllav.xls

Site	Loc	N	GrYld	GrNYld	GrProt
Troop	1	48	1918 b	52.1 b	15.6
Henning	2	48	3510 a	97.2 a	15.9
	SE		116	4.0	0.2

Date	Time	N	GrYld	GrNYld	GrProt
June 1	1	32	2561 b	71.2 b	15.9
June 15	2	32	2781 a	76.5 a	15.8
June 30	3	32	2800 a	76.2 a	15.6
	SE		76	2.2	0.2
	$LSD_{(0.05)}$		152	4.4	0.4

Rate	Rate	N	GrYld	GrNYld	GrProt
Disturbed check	1	24	2605 b	66.9 c	14.8 c
1000 GPA	2	24	2670 ab	72.4 b	15.5 b
2000 GPA	3	24	2741 ab	77.4 ab	16.2 a
3000 GPA	4	24	2841 a	81.9 a	16.6 a
	SE		88	2.6	0.2
	$LSD_{(0.05)}$		175	5.1	0.5

Date	Rate	Time	Rate	N	GrYld	GrNYld	GrProt
June 1	Disturbed check	1	1	8	2396 d	62.8 d	15.1 c
June 1	1000 GPA	1	2	8	2646 cd	70.9 bcd	15.3 c
June 1	2000 GPA	1	3	8	2680 cd	75.6 bc	16.1 b
June 1	3000 GPA	1	4	8	2521 cd	75.5 bc	17.1 a
June 15	Disturbed check	2	1	8	2712 abc	70.4 bcd	15.0 cd
June 15	1000 GPA	2	2	8	2665 cd	72.7 bc	15.6 bc
June 15	2000 GPA	2	3	8	2740 abc	78.0 ab	16.2 b
June 15	3000 GPA	2	4	8	3007 a	85.1 a	16.3 b
June 30	Disturbed check	3	1	8	2708 abc	67.4 cd	14.3 d
June 30	1000 GPA	3	2	8	2698 bcd	73.7 bc	15.6 bc
June 30	2000 GPA	3	3	8	2803 abc	78.7 ab	16.3 b
June 30	3000 GPA	3	4	8	2994 ab	85.0 a	16.3 b
			SE		153	4.5	0.4
			$LSD_{(0.05)}$		304	8.9	0.8

Date	Rate	Time	Rate	N	GrYld		GrNYld		GrProt	
					Troop	Henning	Troop	Henning	Troop	Henning
June 1	Disturbed check	1	1	4	1539 d	3253 e	41.1 d	84.5 e	15.4 e	14.9 def
June 1	1000 GPA	1	2	4	1842 bcd	3451 bc	48.6 bcd	93.3 cde	15.2 cd	15.5 cdef
June 1	2000 GPA	1	3	4	2011 bc	3348 c	54.2 bc	96.9 bcde	15.6 bc	16.6 abc
June 1	3000 GPA	1	4	4	1708 cd	3334 c	49.5 bcd	101.6 abc	16.6 ab	17.6 a
June 15	Disturbed check	2	1	4	1914 bcd	3511 abc	50.3 bcd	90.5 cde	15.1 cd	14.8 ef
June 15	1000 GPA	2	2	4	1810 bcd	3520 abc	47.2 cd	98.1 abcd	15.1 cd	16.0 bcd
June 15	2000 GPA	2	3	4	2032 abc	3448 bc	55.5 bc	100.6 abc	15.7 abc	16.8 ab
June 15	3000 GPA	2	4	4	2444 a	3571 abc	70.9 a	99.2 abcd	16.7 a	15.9 bcde
June 30	Disturbed check	3	1	4	1931 bcd	3484 abc	47.4 cd	87.5 de	14.2 d	14.4 f
June 30	1000 GPA	3	2	4	1929 bcd	3467 bc	51.8 bcd	95.7 cde	15.4 c	15.9 bcde
June 30	2000 GPA	3	3	4	1692 cd	3913 a	49.0 bcd	108.5 ab	16.6 ab	15.9 bcde
June 30	3000 GPA	3	4	4	2166 ab	3821 ab	60.3 ab	109.8 a	16.1 abc	16.5 abc
			SE		216	215.9	6.3	6.3	0.6	0.6
			$LSD_{(0.05)}$		430	430	12.6	12.6	1.1	1.1
			CV		15.9	8.7	17.1	9.2	5.1	5.0
			MSEa		322053.0	322053.0	381.80	381.80	1.45090	1.45090
			MSEb		93191	93191	79.7	79.7	0.6	0.6
			Gr.Mean		1918	3510	52.142	97.172	15.635	15.910

2000: Dr. Jeff Schoenau's Post Emergent Hog Manure Project at Humboldt

Coordinated by Dr. S.P. Mooleki **2000 Summer & final harvest wheat crop.**

This file: C:\My Documents\Jeff\2000work\Data2000\Crop\00CRPEmHogAllav.xls *January 10, 2001*

Disturbed vs undisturbed checks

Loc	Loc	N	GrYld	GrNYld	GrProt
Troop	1	16	1789 b	45.95 b	14.81
Henning	2	16	3321 a	83.90 a	14.50
		SE	147	4.10	0.34

Check	Trt	N	GrYld	GrNYld	GrProt
Undisturbed	1	8	2403 b	59.07 b	14.22
Disturbed June 1	2	8	2396 b	62.79 ab	15.12
Disturbed June 15	6	8	2712 a	70.41 a	14.95
Disturbed June 30	10	8	2708 a	67.42 a	14.33
		SE	124	3.85	0.37
		$LSD_{(0.05)}$	261	8.08	0.77

Check	Trt	N	GrYld		GrNYld		GrProt	
			Troop	Henning	Troop	Henning	Troop	Henning
Undisturbed	1	4	1771 ab	3035 b	45.01	73.13 b	14.61 ab	13.83
Disturbed June 1	2	4	1539 b	3253 ab	41.13	84.45 ab	15.35 a	14.89
Disturbed June 15	6	4	1914 a	3511 a	50.28	90.54 a	15.08 ab	14.82
Disturbed June 30	10	4	1931 a	3484 a	47.37	87.47 a	14.22 b	14.45
		SE	176	176	5.44	5.44	0.52	0.52
		$LSD_{(0.05)}$	370	370	11.43	11.43	1.09	1.09
		CV	13.9	7.5	16.75	9.17	4.95	5.06
		MSEa	172228	172228	134.60	134.60	0.92880	0.92880
		MSEb	61862	61862	59.20	59.20	0.53790	0.53790
		Gr.Mean	1789	3321	45.9483	83.8980	14.8133	14.4975

Summer periodic sampling of disturbed checks

Loc	Loc	N	NO1	NH1	Av.N1	Tissue N conc
			0-30	0-30	0-30	
Troop	1	12	68.3	13.4 a	81.7	38.40 b
Henning	2	12	34.7	3.4 b	38.2	48.03 a
		SE	26.5	3.2	29.5	1.95

Check	Trt	N	NO1	NH1	Av.N1	Tissue N conc
Disturbed June 1	2	8	83.4	11.0	94.4	53.35 a
Disturbed June 15	6	8	46.4	5.8	52.2	47.45 b
Disturbed June 30	10	8	24.7	8.4	33.2	28.84 c
		SE	22.7	2.0	24.3	2.01
		$LSD_{(0.05)}$	49.6	4.4	52.9	4.39

Check	Trt	N	NO1		NH1		Av.N1		Tissue N conc	
			Troop	Henning	Troop	Henning	Troop	Henning	Troop	Henning
Disturbed June 1	2	4	135.3 a	31.5	17.3 a	4.6	152.5 a	36.17	49.98 a	56.73 a
Disturbed June 15	6	4	47.1 b	45.7	9.2 b	2.5	56.3 b	48.20	41.28 b	53.63 a
Disturbed June 30	10	4	22.4 b	27.0	13.8 ab	3.1	36.2 b	30.13	23.95 c	33.73 b
		SE	32.2	32.2	2.9	2.9	34.4	34.4	2.85	2.85
		$LSD_{(0.05)}$	70.1	70.1	6.2	6.2	74.9	74.9	6.21	6.21
		CV	66.6	130.9	30.2	118.4	59.5	127.3	10.49	8.39
		MSEa	4217	4217	61.70	61.70	5215.0	5215.0	22.72	22.72
		MSEb	2069	2069	16.44	16.44	2360.0	2360.0	16.24	16.24
		Gr.Mean	68	35	13.4073	3.4233	81.6733	38.1667	38.400	48.0250

2000: Dr. Jeff Schoenau's Post Emergent Hog Manure Project at Humboldt

Coordinated by Dr. S.P. Mooleki **2000 Wheat crop.** *January 8, 2001*

This file: C:\My Documents\Jeff\2000work\Data2000\Crop\00CRPEmHogAllav.xls
Data file: C:\My Documents\Jeff\2000work\Data2000\Crop\00CRPEmHogTT.xls

Analysis of Variance (Balanced Designs)

MTB > ANOVA 'GrYld' = Loc Rep(Loc) Rate Time Rate*Time Loc*Rate Loc*Time & Loc*Rate*Time;
SUBC> Random 'Rep'; SUBC> EMS; SUBC> Means Loc Rate Time Rate*Time Loc*Rate*Time

Timing by Rate Effect

GrYld

Source	DF	SS	MS	F	P
Loc	1	60825860.0	60825860.0	188.87	0.000 **
Rep(Loc)	6	1932320.0	322053.0	3.46	0.005
Rate	3	733500.0	244500.0	2.62	0.058
Time	2	1135136.0	567568.0	6.09	0.004 **
Rate*Time	6	687531.0	114589.0	1.23	0.303
Loc*Rate	3	126490.0	42163.0	0.45	0.716
Loc*Time	2	316173.0	158086.0	1.70	0.191
Loc*Rate*Time	6	1050489.0	175082.0	1.88	0.098
Error	66	6150617.0	93191.0		
Total	95	72958117.0			

GrNYld

Source	DF	SS	MS	F	P
Loc	1	48662.6	48662.6	127.44	0.000 **
Rep(Loc)	6	2291.0	381.8	4.79	0.000
Rate	3	3007.1	1002.4	12.58	0.000 **
Time	2	574.9	287.4	3.61	0.033 *
Rate*Time	6	222.2	37.0	0.46	0.832
Loc*Rate	3	217.8	72.6	0.91	0.441
Loc*Time	2	208.1	104.1	1.31	0.278
Loc*Rate*Time	6	883.8	147.3	1.85	0.103
Error	66	5260.2	79.7		
Total	95	61327.7			

GrProt

Source	DF	SS	MS	F	P
Loc	1	1.8	1.8	1.24	0.307
Rep(Loc)	6	8.7	1.5	2.26	0.048
Rate	3	44.4	14.8	23.05	0.000 **
Time	2	1.3	0.6	0.99	0.376
Rate*Time	6	5.1	0.8	1.32	0.262
Loc*Rate	3	2.0	0.7	1.03	0.384
Loc*Time	2	0.5	0.3	0.40	0.674
Loc*Rate*Time	6	7.6	1.3	1.97	0.083
Error	66	42.4	0.6		
Total	95	113.7			

2000: Dr. Jeff Schoenau's Post Emergent Hog Manure Project at Humboldt

Coordinated by Dr. S.P. Mooleki **2000 Wheat crop.** *January 10, 2001*

This file: C:\My Documents\Jeff\2000work\Data2000\Crop\00CRPEmHogAllav.xls

Disturbed vs undisturbed checks

Data file: C:\My Documents\Jeff\2000work\Data2000\Crop\00CRPEmHogDisTT.xls

GrYld

Source	DF	SS	MS	F	P	
Loc	1	18779199.0	18779199.0	109.04	0.000	**
Rep(Loc)	6	1033369.0	172228.0	2.78	0.043	
Trt	3	771589.0	257196.0	4.16	0.021	*
Loc*Trt	3	218952.0	72984.0	1.18	0.345	
Error	18	1113519.0	61862.0			
Total	31	21916629.0				

GrProt

Source	DF	SS	MS	F	P
Loc	1	0.80010	0.80010	0.86	0.389
Rep(Loc)	6	5.57270	0.92880	1.73	0.172
Trt	3	4.81560	1.60520	2.98	0.059
Loc*Trt	3	1.06790	0.35600	0.66	0.586
Error	18	9.68240	0.53790		
Total	31	21.93860			

GrNYld

Source	DF	SS	MS	F	P	
Loc	1	11521.40	11521.40	85.57	0.000	**
Rep(Loc)	6	807.90	134.60	2.27	0.083	
Trt	3	601.30	200.40	3.38	0.041	*
Loc*Trt	3	270.60	90.20	1.52	0.243	
Error	18	1066.10	59.20			
Total	31	14267.30				

Summer periodic sampling of disturbed checks

Data file: C:\My Documents\Jeff\2000work\Data2000\FallSoil\00JJPESummerTT.xls

NO1

Source	DF	SS	MS	F	P
Loc	1	6743.0	6743.0	1.60	0.253
Rep(Loc)	6	25300.0	4217.0	2.04	0.138
Trt	2	14084.0	7042.0	3.4	0.067
Loc*Trt	2	14819.0	7410.0	3.58	0.060
Error	12	24823.0	2069.0		
Total	23	85768.0			

Av.N1

Source	DF	SS	MS	F	P
Loc	1	11357.0	11357.0	2.18	0.190
Rep(Loc)	6	31292.0	5215.0	2.21	0.114
Trt	2	15686.0	7843.0	3.32	0.071
Loc*Trt	2	15929.0	7965.0	3.37	0.069
Error	12	28325.0	2360.0		
Total	23	102590.0			

NH1

Source	DF	SS	MS	F	P	
Loc	1	598.080	598.080	9.69	0.021	*
Rep(Loc)	6	370.210	61.700	3.75	0.024	
Trt	2	105.100	52.550	3.2	0.077	
Loc*Trt	2	37.130	18.570	1.13	0.355	
Error	12	197.240	16.440			
Total	23	1307.770				

Tissue N conc.

Source	DF	SS	MS	F	P	
Loc	1	555.840	555.840	24.46	0.003	**
Rep(Loc)	6	136.330	22.720	1.40	0.292	
Trt	2	2618.930	1309.460	80.62	0.000	**
Loc*Trt	2	31.430	15.710	0.97	0.408	
Error	12	194.920	16.240			
Total	23	3537.450				

APPENDIX II

Appendix II

2001 Project Data

Post Emergent Injection of Swine Effluent at Two Sites Near Leroy, 2001, on Spring Wheat

Grain Yield and Protein: Leroy 2 site yielded better than Leroy 1 site. Date of application (May 31, June 13, June 27) had a significant effect on yield, with later applications associated with lower yield and no protein benefit, presumably due to greater crop damage at the later dates.

Compared to the disturbed check, for each time interval, manure application at 1000, 2000 and 3000 gpa did not produce significant yield increases, and yields were all around 38 bushels/acre for control and manure treatments at Leroy 2 on May 31, 31 bushels/acre for treatments on June 13, and 27 bushels/acre for treatments on June 27. Both fields (Leroy 1 and 2) had pretty good N fertility to start with and given the dry conditions did not respond in yield. Tissue N concentrations revealed the good N fertility status of the fields, with about 5% N concentration. With this high N concentration in the tissue indicating good N fertility, a large yield response to additional N applied post-emergent is not expected. In the third year, a concerted effort should be made to select a field with low N fertility to begin with.

Protein content was increased by about 1% point from the control (17%) to 2000 gpa (18%), with no further protein gains from 2000 gpa to 3000 gpa.

In 2001, late disturbance after the end of May (June 13 and 27 dates) was responsible for a large and significant reduction in yield: 10 to 15 bushels/acre ! Overall, in 2001, post emergent application after the end of May would have a negative economic effect because of the yield reductions associated with the disturbance itself. This is in contrast to the observations in 2000 where the disturbance itself had a positive effect on yield.

2001: Dr. Jeff Schoenau's Post Emergent Hog Manure Project at Leroy

Coordinated by Dr. S.P. Mooleki

2001 Wheat crop *December 15, 2001*

This file: C:\My Documents\Jeff\2001 work\Data2001\Crop\01CrpJJPEmFHAv.xls

Site	Loc	N	GrYld	GrNYld	GrNConc	GrProt
Leroy 1	1	48	1768	53.3	30.2	17.3
Leroy 2	2	48	2071	62.7	30.3	17.4
SE			196	5.7	0.3	0.2

Date	Time	N	GrYld	GrNYld	GrNConc	GrProt
May 31	1	32	2210 a	67.2 a	30.4	17.5
June 13	2	32	1827 b	55.4 b	30.4	17.5
June 27	3	32	1722 b	51.6 b	29.9	17.2
SE			81	2.4	0.3	0.2
$LSD_{(0.05)}$			161	4.7	0.6	0.3

Rate	Rate	N	GrYld	GrNYld	GrNConc	GrProt
Disturbed check	1	24	1869	54.5	29.2 c	16.8 c
1000 GPA	2	24	1918	57.5	30.0 b	17.3 b
2000 GPA	3	24	1944	59.8	30.8 a	17.7 a
3000 GPA	4	24	1947	60.3	30.9 a	17.8 a
SE			94	2.7	0.3	0.2
$LSD_{(0.05)}$			186	5.5	0.6	0.4

Date	Rate	Time	Rate	N	GrYld	GrNYld	GrNConc	GrProt
May 31	Disturbed check	1	1	8	2139 abc	63.9 abc	29.9 bc	17.2 bc
May 31	1000 GPA	1	2	8	2223 ab	66.1 ab	29.7 bc	17.1 bc
May 31	2000 GPA	1	3	8	2195 ab	67.2 ab	30.7 ab	17.7 ab
May 31	3000 GPA	1	4	8	2284 a	71.4 a	31.3 a	18.0 a
June 13	Disturbed check	2	1	8	1870 bcd	54.5 cd	29.3 cd	16.8 cd
June 13	1000 GPA	2	2	8	1764 d	53.7 cd	30.4 abc	17.5 abc
June 13	2000 GPA	2	3	8	1875 bcd	57.7 bc	30.9 ab	17.7 ab
June 13	3000 GPA	2	4	8	1797 cd	55.7 cd	31.0 ab	17.8 ab
June 27	Disturbed check	3	1	8	1596 d	45.2 d	28.4 d	16.3 d
June 27	1000 GPA	3	2	8	1767 d	52.9 cd	30.0 abc	17.2 bc
June 27	2000 GPA	3	3	8	1764 d	54.5 cd	30.8 ab	17.7 ab
June 27	3000 GPA	3	4	8	1761 d	53.6 cd	30.5 abc	17.6 ab
SE					162	4.7	0.6	0.3
$LSD_{(0.05)}$					322	9.4	1.1	0.6

Date	Rate	Time	Rate	N	GrYld		GrNYld		GrNConc		GrProt	
					Leroy 1	Leroy 2	Leroy 1	Leroy 2	Leroy 1	Leroy 2	Leroy 1	Leroy 2
May 31	Disturbed check	1	1	4	1808	2471 a	53.3 ab	74.4 a	29.5 ab	30.2 ab	17.0 ab	17.4 ab
May 31	1000 GPA	1	2	4	1942	2504 a	57.9 ab	74.3 a	29.8 ab	29.6 bc	17.1 ab	17.0 bc
May 31	2000 GPA	1	3	4	1977	2412 a	61.2 a	73.2 ab	31.0 a	30.5 ab	17.8 a	17.5 ab
May 31	3000 GPA	1	4	4	2076	2493 a	63.8 a	79.1 a	30.8 a	31.8 a	17.7 a	18.3 a
June 13	Disturbed check	2	1	4	1863	1878 b	54.2 ab	54.8 cd	29.2 ab	29.4 bc	16.8 ab	16.9 bc
June 13	1000 GPA	2	2	4	1623	1904 b	48.5 ab	58.8 bcd	29.9 ab	30.8 ab	17.2 ab	17.7 ab
June 13	2000 GPA	2	3	4	1657	2093 ab	50.8 ab	64.7 abc	30.7 a	31.0 ab	17.6 ab	17.8 ab
June 13	3000 GPA	2	4	4	1674	1920 b	52.0 ab	59.4 bcd	31.0 a	31.0 ab	17.8 a	17.8 ab
June 27	Disturbed check	3	1	4	1555	1638 b	44.8 b	45.6 d	28.8 b	28.0 c	16.6 b	16.1 c
June 27	1000 GPA	3	2	4	1646	1886 b	49.7 ab	56.1 cd	30.1 ab	29.9 b	17.3 ab	17.2 b
June 27	2000 GPA	3	3	4	1630	1897 b	49.7 ab	59.3 bcd	30.5 ab	31.2 ab	17.5 ab	17.9 ab
June 27	3000 GPA	3	4	4	1766	1756 b	54.1 ab	53.2 cd	30.7 a	30.4 ab	17.6 ab	17.5 ab
SE					229	229.2	6.7	6.7	0.8	0.8	0.5	0.5
$LSD_{(0.05)}$					456	456	13.4	13.4	1.6	1.6	0.9	0.9
CV					18.3	15.7	17.8	15.1	3.7	3.7	3.7	3.7
MSEa					922048.0	922048.0	780.550	780.550	1.9160	1.9160	0.63340	0.63340
MSEb					105041	105041	90.140	90.140	1.2660	1.2660	0.41870	0.41870
Gr.Mean					1768	2071	53.346	62.737	30.158	30.308	17.341	17.427

2001: Dr. Jeff Schoenau's Post Emergent Hog Manure Project at Leroy

Coordinated by Dr. S.P. Mooleki **2001 Summer & final harvest wheat crop**

December 15, 2001

This file: C:\My Documents\Jeff\2001work\Data2001\Crop\01CrpJJPEmFHAv.xls

Disturbed vs undisturbed checks

Loc	Loc	N	GrYld	GrNYld	GrNConc	GrProt	Tissue N conc
Leroy 1	1	16	1811	52.4	29.0	16.7	44.5
Leroy 2	2	16	2144	62.6	29.2	16.8	45.3
		SE	201	5.8	0.5	0.3	1.0

Check	Trt	N	GrYld	GrNYld	GrNConc	GrProt	Tissue N conc
Undisturbed	1	8	2303 a	66.4 a	28.8 b	16.6 b	-
Disturbed May 31	2	8	2139 a	63.9 a	29.9 a	17.2 a	54.3 a
Disturbed June 13	6	8	1870 ab	54.5 ab	29.3 ab	16.8 ab	50.4 a
Disturbed June 27	10	8	1596 b	45.2 b	28.4 b	16.3 b	30.1 b
		SE	233	6.3	0.5	0.3	1.8
		$LSD_{(0.05)}$	489	13.3	1.1	0.6	4.0

Check	Trt	N	GrYld		GrNYld		GrNConc		GrProt		Tissue N conc	
			Leroy 1	Leroy 2	Leroy 1	Leroy 2	Leroy 1	Leroy 2	Leroy 1	Leroy 2	Leroy 1	Leroy 2
Undisturbed	1	4	2017	2589 a 40	57.2	75.6 a	28.5	29.1 ab	16.4	16.7 ab	-	-
Disturbed May 31	2	4	1808	2471 ab	53.3	74.4 a	29.5	30.2 a	17.0	17.4 a	54.1 a	54.5 a
Disturbed June 13	6	4	1863	1878 bc	54.2	54.8 b	29.2	29.4 ab	16.8	16.9 ab	49.5 a	51.3 a
Disturbed June 27	10	4	1555	1638 c	44.8	45.6 b	28.8	28.0 b	16.6	16.1 b	30.0 b	30.3 b
		SE	329	329	9.0	9.0	0.7	0.7	0.4	0.4	2.6	2.6
		$LSD_{(0.05)}$	692	692	18.9	18.9	1.5	1.5	0.9	0.9	5.7	5.7
		CV	25.7	21.7	24.2	20.3	3.6	3.5	3.6	3.5	8.3	8.1
		MSEa	323592	323592	245.90	165.90	2.1330	2.1330	0.70530	0.70530	7.310	7.310
		MSEb	217004	217004	161.20	161.20	1.0710	1.0710	0.35420	0.35420	13.340	13.340
		GrMean	1811	2144	52.3688	62.6040	28.9813	29.5813	16.6640	16.7790	44.5333	45.3333

Concentrations in *Hog Manure* Applied at Leroy Post Emergent no. 1 Site May 31 2001

Tot. N	NH4	NO3	Tot. P	Avail P	K	Ca	Mg	Cu	Fe	Mn	Zn	B	Na
ug/ml													
3397	2199	-	139	61	1472	407	117	4.4	13.9	2.2	17.6	2.1	1026

Application rates of nutrient in kg/ha

Rate gpa														
1000	32	21	-	1.3	0.6	14	3.8	1.1	0.04	0.13	0.02	0.16	0.02	9.6

Concentrations in *Hog Manure* Applied at Leroy Post Emergent no. 1 Site June 13 2001

Tot. N	NH4	NO3	Tot. P	Avail P	K	Ca	Mg	Cu	Fe	Mn	Zn	B	Na
ug/ml													
5188	3249	-	963	71	1993	1047	616	12.7	51.5	14	40.0	2.4	1476

Application rates of nutrient in kg/ha

Rate gpa														
1000	48.5	30.4	-	9.0	0.7	18.6	9.8	5.8	0.12	0.48	0.13	0.37	0.03	13.8

Concentrations in *Hog Manure* Applied at Leroy Post Emergent no. 1 Site June 27 2001

	Tot. N	NH4	NO3	Tot. P	Avail P	K	Ca	Mg	Cu	Fe	Mn	Zn	B	Na
	ug/ml													
	5350	2310	-	802	73	1987	778	533	14.3	55.6	12.8	45.8	2.8	1413
	Application rates of nutrient in kg/ha													
Rate gpa														
1000	50	21.6	-	7.5	0.7	18.6	7.3	5.0	0.13	0.52	0.12	0.43	0.03	13.2

Concentrations in *Hog Manure* Applied at Leroy Post Emergent no. 2 Site May 31 2001

	Tot. N	NH4	NO3	Tot. P	Avail P	K	Ca	Mg	Cu	Fe	Mn	Zn	B	Na
	ug/ml													
	3137	2052	-	158	56	1362	393	93	4.7	14.1	2.4	14.3	1.5	964
	Application rates of nutrient in kg/ha													
Rate gpa														
1000	29	19	-	1.5	0.5	13	3.7	0.9	0.04	0.13	0.02	0.13	0.01	9.0

Concentrations in *Hog Manure* Applied at Leroy Post Emergent no. 2 Site June 13 2001

	Tot. N	NH4	NO3	Tot. P	Avail P	K	Ca	Mg	Cu	Fe	Mn	Zn	B	Na
	ug/ml													
	3574	2367	-	277	63	1461	455	164	5.2	18.3	4.0	16.0	2.7	1029
	Application rates of nutrient in kg/ha													
Rate gpa														
1000	33.4	22.1	-	2.6	0.6	13.7	4.3	1.5	0.05	0.17	0.04	0.15	0.02	9.6

Concentrations in *Hog Manure* Applied at Leroy Post Emergent no. 2Site June 27 2001

	Tot. N	NH4	NO3	Tot. P	Avail P	K	Ca	Mg	Cu	Fe	Mn	Zn	B	Na
	ug/ml													
	4084	2955	-	274	75	1656	491	165	6.6	21.2	4.3	18.2	1.9	1191
	Application rates of nutrient in kg/ha													
Rate gpa														
1000	38.2	27.6	-	2.6	0.7	15.5	4.6	1.5	0.06	0.20	0.04	0.17	0.02	11.1

5200G RTES 2 Yield Raw Data 2001

Site #1 North Of Yard

	Treatment	Rep1		Rep2		Rep3		Rep4		Mean
		kg	bu/acre	kg	bu/acre	kg	bu/acre	kg	bu/acre	bu/acre
Check No Dis	1	8.58	33.4	9.16	35.7	7	27.3	6	23.4	29.9
Check May 31	2	7.76	30.2	6.58	25.6	6.86	26.7	6.36	24.8	26.8
1000 gpa May 31	3	8.02	31.2	7.84	30.5	7.2	28.0	6.54	25.5	28.8
2000 gpa May 31	4	7.54	29.4	8.7	33.9	7.66	29.8	6.24	24.3	29.4
3000 gpa May 31	5	8.32	32.4	8.58	33.4	7.94	30.9	6.8	26.5	30.8
Check June 13	6	6.18	24.1	9.32	36.3	6.42	25.0	6.48	25.2	27.7
1000 gpa June 13	7	6.2	24.2	7.12	27.7	5.78	22.5	5.64	22.0	24.1
2000 gpa June 13	8	5.64	22.0	7.16	27.9	5.92	23.1	6.54	25.5	24.6
3000 gpa June 13	9	5.56	21.7	7.84	30.5	6.9	26.9	5.22	20.3	24.9
Check June 30	10	5.36	20.9	8.4	32.7	5.48	21.3	4.46	17.4	23.1
1000 gpa June 30	11	6.24	24.3	6.84	26.6	5.86	22.8	6.18	24.1	24.5
2000 gpa June 30	12	6.62	25.8	7.12	27.7	6.18	24.1	4.92	19.2	24.2
3000 gpa June 30	13	7.18	28.0	8.46	33.0	5.94	23.1	5.34	20.8	26.2
		Mean	26.7		30.9		25.5		23.0	

Site #2 South Of Highway

	Treatment	Rep1		Rep2		Rep3		Rep4		Mean
		kg	bu/acre	kg	bu/acre	kg	bu/acre	kg	bu/acre	bu/acre
Check No Dis	1	14	54.5	6.2	24.2	9.52	37.1	9.74	37.9	38.4
Check May 31	2	10.02	39.0	10.6	41.4	8.54	33.3	8.46	33.0	36.7
1000 gpa May 31	3	9.68	37.7	6.98	27.2	13	50.5	8.54	33.3	37.2
2000 gpa May 31	4	7.8	30.4	6.52	25.4	12.4	48.3	10	39.1	35.8
3000 gpa May 31	5	8.1	31.6	11.6	45.0	8.08	31.5	10.3	40.0	37.0
Check June 13	6	5.72	22.3	5.14	20.0	10.8	42.1	6.96	27.1	27.9
1000 gpa June 13	7	6.6	25.7	7.44	29.0	8.16	31.8	6.82	26.6	28.3
2000 gpa June 13	8	6.44	25.1	6.64	25.9	11.8	46.0	7.02	27.3	31.1
3000 gpa June 13	9	6.18	24.1	7.92	30.9	7.74	30.2	7.42	28.9	28.5
Check June 30	10	5.3	20.6	4.42	17.2	7.16	27.9	8.08	31.5	24.3
1000 gpa June 30	11	4.8	18.7	7.38	28.7	10.3	40.1	6.26	24.4	28.0
2000 gpa June 30	12	5.1	19.9	6.6	25.7	9.04	35.2	8.18	31.9	28.2
3000 gpa June 30	13	5.5	21.4	4.28	16.7	8	31.2	8.98	35.0	26.1
			28.5		27.5		37.3		32.0	

5200G RTES 2 Yield Raw Data 2001

Site #1 North Of Yard

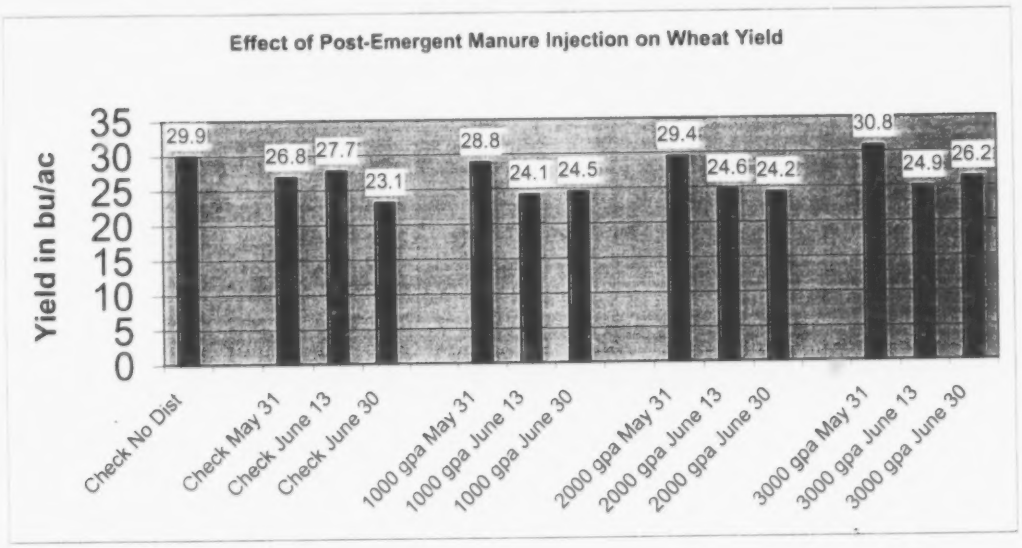
	Treatment	Rep1		Rep2		Rep3		Rep4		Mean
		kg	kg/ha	kg	kg/ha	kg	kg/ha	kg	kg/ha	kg/ha
Check No Dis	1	8.58	2251.6	9.16	2403.8	7	1837.0	6	1574.6	2016.7
Check May 31	2	7.76	2036.4	6.58	1726.8	6.86	1800.2	6.36	1669.0	1808.1
1000 gpa May 31	3	8.02	2104.7	7.84	2057.4	7.2	1889.5	6.54	1716.3	1942.0
2000 gpa May 31	4	7.54	1978.7	8.7	2283.1	7.66	2010.2	6.24	1637.5	1977.4
3000 gpa May 31	5	8.32	2183.4	8.58	2251.6	7.94	2083.7	6.8	1784.5	2075.8
Check June13	6	6.18	1621.8	9.32	2445.8	6.42	1684.8	6.48	1700.5	1863.2
1000 gpa June 13	7	6.2	1627.0	7.12	1868.5	5.78	1516.8	5.64	1480.1	1623.1
2000 gpa June 13	8	5.64	1480.1	7.16	1879.0	5.92	1553.6	6.54	1716.3	1657.2
3000 gpa June 13	9	5.56	1459.1	7.84	2057.4	6.9	1810.7	5.22	1369.9	1674.3
Check June 30	10	5.36	1406.6	8.4	2204.4	5.48	1438.1	4.46	1170.4	1554.9
1000 gpa June 30	11	6.24	1637.5	6.84	1795.0	5.86	1537.8	6.18	1621.8	1648.0
2000 gpa June 30	12	6.62	1737.3	7.12	1868.5	6.18	1621.8	4.92	1291.1	1629.7
3000 gpa June 30	13	7.18	1884.2	8.46	2220.1	5.94	1558.8	5.34	1401.4	1766.1
		Mean	1800.6		2081.6		1718.7		1548.7	

Site #2 South Of Highway

	Treatment	Rep1		Rep2		Rep3		Rep4		Mean
		kg	kg/ha	kg	kg/ha	kg	kg/ha	kg	kg/ha	kg/ha
Check No Dis	1	14	3674.0	6.2	1627.0	9.52	2498.3	9.74	2556.0	2588.8
Check May 31	2	10.02	2629.5	10.64	2792.2	8.54	2241.1	8.46	2220.1	2470.7
1000 gpa May 31	3	9.68	2540.3	6.98	1831.7	12.96	3401.0	8.54	2241.1	2503.5
2000 gpa May 31	4	7.8	2046.9	6.52	1711.0	12.4	3254.1	10.04	2634.8	2411.7
3000 gpa May 31	5	8.1	2125.6	11.56	3033.6	8.08	2120.4	10.26	2692.5	2493.0
Check June 13	6	5.72	1501.1	5.14	1348.9	10.8	2834.2	6.96	1826.5	1877.7
1000 gpa June 13	7	6.6	1732.0	7.44	1952.4	8.16	2141.4	6.82	1789.7	1903.9
2000 gpa June 13	8	6.44	1690.0	6.64	1742.5	11.8	3096.6	7.02	1842.2	2092.8
3000 gpa June 13	9	6.18	1621.8	7.92	2078.4	7.74	2031.2	7.42	1947.2	1919.6
Check June 30	10	5.3	1390.9	4.42	1159.9	7.16	1879.0	8.08	2120.4	1637.5
1000 gpa June 30	11	4.8	1259.6	7.38	1936.7	10.3	2703.0	6.26	1642.8	1885.5
2000 gpa June 30	12	5.1	1338.4	6.6	1732.0	9.04	2372.3	8.18	2146.6	1897.3
3000 gpa June 30	13	5.5	1443.3	4.28	1123.2	8	2099.4	8.98	2356.6	1755.6
			1922.6		1851.5		2513.2		2155.1	

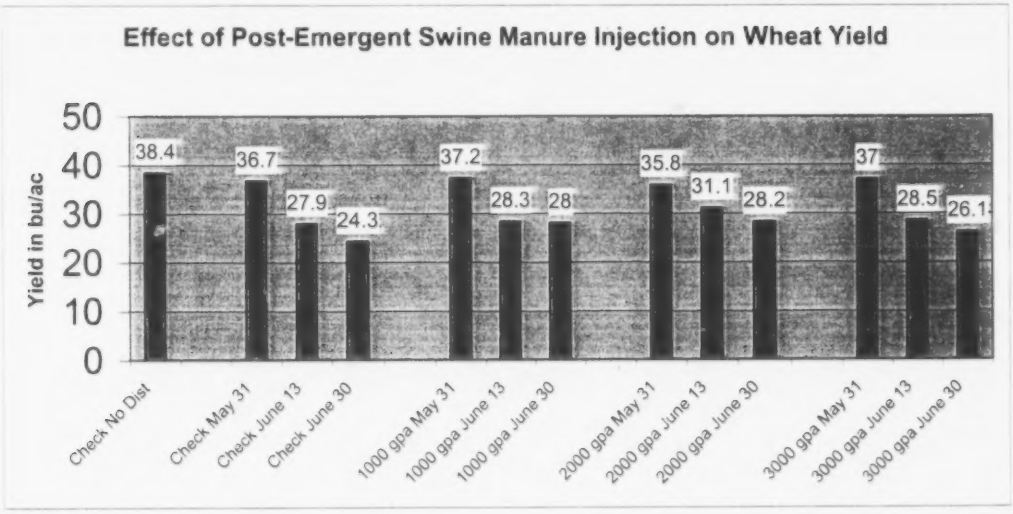
5200G Yield Data Site #1 - 2001 Bushels/ac

Treatment	bu/ac
Check No Dist	29.9
Check May 31	26.8
Check June 13	27.7
Check June 30	23.1
1000 gpa May 31	28.8
1000 gpa June 13	24.1
1000 gpa June 30	24.5
2000 gpa May 31	29.4
2000 gpa June 13	24.6
2000 gpa June 30	24.2
3000 gpa May 31	30.8
3000 gpa June 13	24.9
3000 gpa June 30	26.2



5200G Yield Data Site #2 - 2001 Bushels/ac

Treatment	bu/ac
Check No Dist	38.4
Check May 31	36.7
Check June 13	27.9
Check June 30	24.3
1000 gpa May 31	37.2
1000 gpa June 13	28.3
1000 gpa June 30	28
2000 gpa May 31	35.8
2000 gpa June 13	31.1
2000 gpa June 30	28.2
3000 gpa May 31	37
3000 gpa June 13	28.5
3000 gpa June 30	26.1



APPENDIX III

Appendix III

2002 Project Data

2002: Dr. Jeff Schoenau's Post Emergent Hog Manure Project at Humboldt

Coordinated by Dr. S.P. Mooleki **2002 Wheat crop**

This file: C:\My Documents\Jeff\2002work\Data2002\Crop\02CrpJJPoEmergFactoAV.xls
Data file: C:\My Documents\Jeff\2002work\Data2002\Crop\02CrpJJPoEmergFactoTT.xls

December 27, 2002

MEANS — Grain Yield

Effect of Location

Loc	N	
Site 1	48	2027 a
Site 2	48	1624 b
	SE	**176**

Effect of date

Date	N	Over sites	Within sites N	Site 1	Site 2
1	32	1994 a	16	2219 a	1768 a
2	32	1947 a	16	2159 a	1734 a
3	32	1536 b	16	1702 b	1370 b
	SE	55	SE	77	
	$LSD_{0.05}$	**97**	$LSD_{0.05}$	**137**	

Within Rate

	Date	N	Dist Ck	100 gpa	200 gpa	300 gpa
Site #1	Jun 7	4	2117 a	2201 a	2278 a	2279 a
	Jun 21	4	2037 a	2168 a	2164 a	2267 a
	Jul 5	4	1662 b	1672 b	1711 b	1764 b
Site #2	Jun 7	4	1631 a	1604 a	2199 a	1638 ab
	Jun 21	4	1598 a	1833 a	1696 b	1810 a
	Jul 5	4	1303 b	1426 b	1362 c	1388 b
	G&Gp205#10	SE	161			
		$LSD_{0.05}$	**269**			

Effect of Rate

	Rate	N	Over sites	Within sites N	Site 1	Site 2
Dist Ck	1	24	1725 b	12	1939	1511 b
100 gpa	2	24	1817 ab	12	2014	1621 ab
200 gpa	3	24	1902 a	12	2051	1752 a
300 gpa	4	24	1858 a	12	2104	1612 ab
		SE	66		94	
		$LSD_{0.05}$	**111**		**157**	

Effect of rate within date of application over Sites

	Rate	N	June 7	June 21	July 05
Dist Ck	1	8	1874	1818	1483
100 gpa	2	8	1903	2000	1549
200 gpa	3	8	2238	1930	1536
300 gpa	4	8	1959	2039	1576
		SE	115		
		$LSD_{0.05}$	**193**		

Effect of rate within Site and date of application

	Rate	N	Site #1 June 7	Site #1 June 21	Site #1 July 05	Site #2 June 7	Site #2 June 21	Site #2 July 05
Dist Ck	1	4	2117	2037	1662	1631 b	1598 b	1303
100 gpa	2	4	2201	2168	1672	1604 b	1833 a	1426
200 gpa	3	4	2278	2164	1711	2199 a	1696 ab	1362
300 gpa	4	4	2279	2267	1764	1638 b	1810 a	1388
	G&Gp205#7	SE	163					
		$LSD_{0.05}$	**272**					
		CV	13					
	MSEa	6	746383					
	MSEb	12	47605					
	MSEc	54	52928					
	G.Mean		1825					

2002: Dr. Jeff Schoenau's Post Emergent Hog Manure Project at Humboldt

Coordinated by Dr. S.P. Mooleki **2002 Wheat crop**

This file: C:\My Documents\Jeff\2002work\Data2002\Crop\02CrpJJPoEmergFactoAV.xls
Data file: C:\My Documents\Jeff\2002work\Data2002\Crop\02CrpJJPoEmergFactoTT.xls

January 17, 2003

MEANS Grain Protein

Effect of Location

Loc	N	
Site 1	48	13.5 b
Site 2	48	14.5 a
	SE	**0.2**

Effect of date

Date	N	Over sites	N	Within sites: Site 1	Within sites: Site 2
1	32	13.8 b	16	13.2 b	14.5 b
2	32	13.9 b	16	13.5 ab	14.3 b
3	32	14.3 a	16	13.8 a	14.8 a
	SE	0.2	SE	0.2	
	$LSD_{(0.1)}$	**0.3**	$LSD_{(0.1)}$	**0.4**	

	Date	N	Within Rate: Dist Ck	100 gpa	200 gpa	300 gpa
Site #1	Jun 7	4	13.1	12.8 b	13.3 b	13.5
	Jun 21	4	13.1	13.5 a	13.3 b	14.0
	Jul 5	4	13.5	13.8 a	14.0 a	13.7
Site #2	Jun 7	4	14.0	14.4	14.6	15.0
	Jun 21	4	14.2	14.1	14.2	14.8
	Jul 5	4	14.6	14.4	14.8	15.2
	G&Gp205#10	SE	0.4			
		$LSD_{(0.1)}$	**0.7**			

Effect of Rate

	Rate	N	Over sites	N	Within sites: Site 1	Within sites: Site 2
Dist Ck	1	24	13.7 c	12	13.2 b	14.3 b
100 gpa	2	24	13.8 bc	12	13.4 ab	14.3 b
200 gpa	3	24	14.0 b	12	13.6 a	14.5 b
300 gpa	4	24	14.4 a	12	13.7 a	15.0 a
		SE	0.2		0.2	
		$LSD_{(0.1)}$	**0.3**		**0.4**	

Effect of rate within date of application over Sites

	Rate	N	June 7	June 21	July 05
Dist Ck	1	8	13.5 c	13.6 b	14.0 b
100 gpa	2	8	13.6 bc	13.8 b	14.1 ab
200 gpa	3	8	14.0 ab	13.7 b	14.4 ab
300 gpa	4	8	14.3 a	14.4 a	14.5 a
		SE	0.3		
		$LSD_{(0.1)}$	**0.5**		

Effect of rate within Site and date of application

	Rate	N	Site #1: June 7	Site #1: June 21	Site #1: July 05	Site #2: June 7	Site #2: June 21	Site #2: July 05
Dist Ck	1	4	13.1 ab	13.1 b	13.5	14.0 b	14.2 ab	14.6 ab
100 gpa	2	4	12.8 b	13.5 ab	13.8	14.4 ab	14.1 b	14.4 b
200 gpa	3	4	13.3 ab	13.3 b	14.0	14.6 ab	14.2 ab	14.8 ab
300 gpa	4	4	13.5 a	14.0 a	13.7	15.0 a	14.8 a	15.2 a
	G&Gp205#7	SE	0.4					
		$LSD_{(0.1)}$	**0.7**					
		CV	4.2					
	MSEa	6	0.9299					
	MSEb	12	0.4073					
	MSEc	54	0.3481					
	G.Mean		14.0					

002: Dr. Jeff Schoenau's Post Emergent Hog Manure Project at Humboldt

Coordinated by Dr. S.P. Mooleki **2002 Wheat crop**

This file: C:\My Documents\Jeff\2002work\Data2002\Crop\02CrpJJPoEmergFactoAV.xls
Data file: C:\My Documents\Jeff\2002work\Data2002\Crop\02CrpJJPoEmergCKTT.xls

January 20, 2003

Disturbed vs undisturbed checks

Loc	Loc	N	GrYld	Grain Protein
Site 1	1	16	2010 a	13.2 b
Site 2	2	16	1516 b	14.3 a
		SE	179	0.3

Check	Trt	N	GrYld	Grain Protein
Undisturbed	1	8	1877 a	13.8 ab
Disturbed June 7	2	8	1874 a	13.5 b
Disturbed June 21	6	8	1818 a	13.6 ab
Disturbed July 5	10	8	1483 b	14.0 a
		SE	72	0.3
		$LSD_{(0.1)}$	125	0.5

Check	Trt	N	GrYld		Grain Protein	
			Site 1	Site 2	Site 1	Site 2
Undisturbed	1	4	2223 a	1532 a	13.2	14.4
Disturbed June 7	2	4	2117 ab	1631 a	13.1	14.0
Disturbed June 21	6	4	2037 b	1598 a	13.1	14.2
Disturbed July 5	10	4	1662 c	1303 b	13.5	14.6
		SE	102		0.4	
		$LSD_{(0.1)}$	177		0.7	
		CV	8.2		4.4	
		MSEa	257306		[illegible]	
		MSEb	20829		[illegible]	
		Gr.Mean	1763		13.8	

Concentrations in *Hog Manure* Applied at Dixon Post Emergent Trials June 7 2002

	Tot. N	NH4	NO3	Tot. P	Avail P	K	Ca	Mg	Cu	Fe	Mn	Zn	B	Na
	ug/ml													
	3255	1974	-	127	3.9	1319	345	139	1.2	31.3	2.2	2.3	-	576
	Application rates of nutrient in kg/ha													
Rate gpa														
1000	33	20	-	1.3	0.04	13	3.5	1.4	0.01	0.31	0.02	0.02	-	5.8

Concentrations in *Hog Manure* Applied at Dixon Post Emergent Trials June 21 2002

	Tot. N	NH4	NO3	Tot. P	Avail P	K	Ca	Mg	Cu	Fe	Mn	Zn	B	Na
	ug/ml													
	2853	1633	-	116	3.2	1132	368	129	1.1	18.2	2.1	2.2	-	507
	Application rates of nutrient in kg/ha													
Rate gpa														
1000	29	16	-	1.2	.03	11.3	3.7	1.3	0.01	1.8	0.02	0.02	-	5.1

Concentrations in *Hog Manure* Applied at Dixon Post Emergent Trials July 4 2002

	Tot. N	NH4	NO3	Tot. P	Avail P	K	Ca	Mg	Cu	Fe	Mn	Zn	B	Na
	ug/ml													
	3377	2209	-	96	3.2	1306	467	383	1.0	19.2	2.6	13.4	-	720
	Application rates of nutrient in kg/ha													
Rate gpa														
1000	34	22	-	1.0	0.03	13	4.7	3.8	0.01	0.20	0.03	0.13	-	7.2

5200G Post Emergent Manure - Yield Raw Data 2002

Site #1 North of Long Term Swine Manure Plots - Data Enterd and Proofed including formulas Sept 19, 2002

	Treatment	Rep1		Rep2		Rep3		Rep4		Mean
		kg	bu/acre	kg	bu/acre	kg	bu/acre	kg	bu/acre	bu/acre
Check No Dis	1	7.16	28.6	8.66	34.7	8.28	33.1	8.96	35.9	33.1
Check June 7	2	6.98	27.9	8.78	35.1	7.76	31.1	7.96	31.9	31.5
1000 gpa June 7	3	7.82	31.3	8.38	33.5	8.74	35.0	7.8	31.2	32.8
2000 gpaJune 7	4	7.58	30.3	8.8	35.2	9.38	37.5	8.12	32.5	33.9
3000 gpa June 7	5	7.76	31.1	9	36.0	8.38	33.5	8.76	35.1	33.9
Check June 21	6	7.02	28.1	7.82	31.3	7.88	31.5	7.58	30.3	30.3
1000 gpa June 21	7	7.92	31.7	8.78	35.1	7.64	30.6	7.9	31.6	32.3
2000 gpa June 21	8	7.8	31.2	8.62	34.5	8.42	33.7	7.34	29.4	32.2
3000 gpa June 21	9	7.92	31.7	9.18	36.7	8.32	33.3	8.3	33.2	33.7
Check July 4	10	6	24.0	5.88	23.5	5.8	23.2	7.04	28.2	24.7
1000 gpa July 4	11	6.12	24.5	6.38	25.5	6.62	26.5	5.74	23.0	24.9
2000 gpa July 4	12	6.04	24.2	6.88	27.5	6.52	26.1	6	24.0	25.4
3000 gpa July 4	13	6.14	24.6	6.84	27.4	5.98	23.9	7.28	29.1	26.2
		Mean	28.4		32.0		30.7		30.4	

Site #2 South and West of Collin Fords - data checked Sept 19, 2002 as per site #1

	Treatment	Rep1		Rep2		Rep3		Rep4		Mean
		kg	bu/acre	kg	bu/acre	kg	bu/acre	kg	bu/acre	bu/acre
Check No Dis	1	3.84	15.4	5.02	20.1	6.9	27.6	7.02	28.1	22.8
Check June 7	2	4.56	18.2	6.54	26.2	6.46	25.8	6.7	26.8	24.3
1000 gpa June 7	3	3.58	14.3	5.64	22.6	6.24	25.0	8.4	33.6	23.9
2000 gpaJune 7	4	7.80	31.2	5.32	21.3	12.4	6.5	7.18	28.7	21.9
3000 gpa June 7	5	4.02	16.1	6.84	27.4	6.58	26.3	6.92	27.7	24.4
Check June 21	6	4.26	17.0	4.96	19.8	6.6	26.4	7.94	31.8	23.8
1000 gpa June 21	7	4.64	18.6	6.68	26.7	7.7	30.8	8.24	33.0	27.3
2000 gpa June 21	8	4.06	16.2	6.3	25.2	6.66	26.6	8.2	32.8	25.2
3000 gpa June 21	9	4.52	18.1	7.18	28.7	6.68	26.7	8.54	34.2	26.9
Check July 4	10	3.54	14.2	4.56	18.2	5.9	23.6	5.38	21.5	19.4
1000 gpa July 4	11	3.28	13.1	5.72	22.9	5.08	20.3	7.12	28.5	21.2
2000 gpa July 4	12	3.76	15.0	5.66	22.6	5.04	20.2	5.8	23.2	20.3
3000 gpa July 4	13	4.54	18.2	3.94	15.8	5.56	22.2	6.6	26.4	20.6
			17.4		22.9		23.7		28.9	

5200G Post Emergent Manure - Yield Raw Data 2002

Site #1 North Of Yard - Data entered and checked, formulas changed Sept 19, 2002

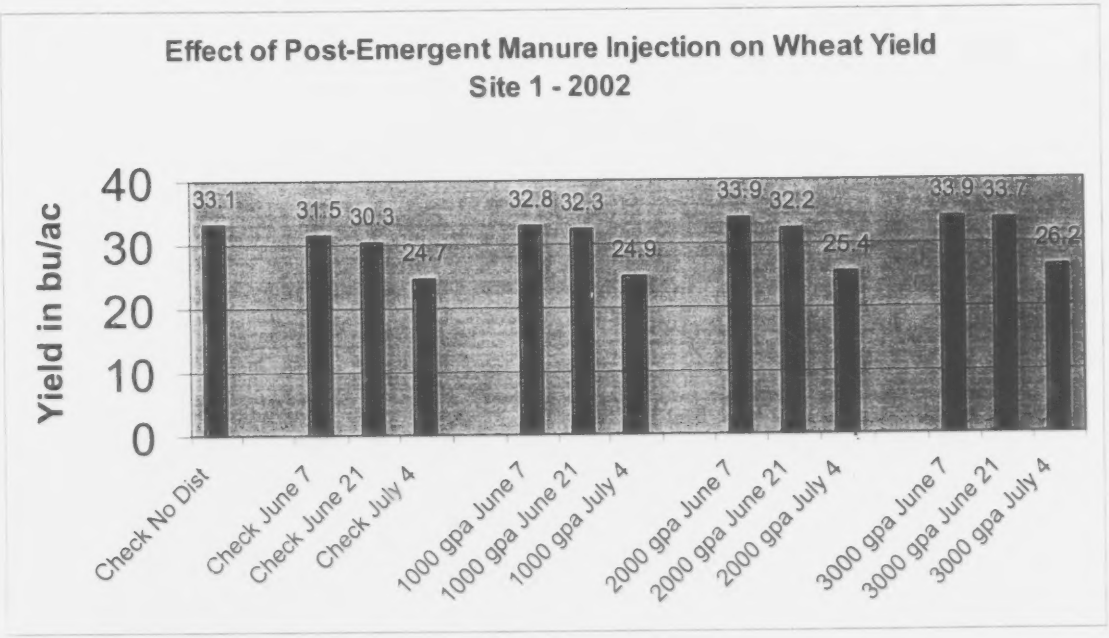
	Treatment	Rep1		Rep2		Rep3		Rep4		Mean
		kg	kg/ha	kg	kg/ha	kg	kg/ha	kg	kg/ha	kg/ha
Check No Dis	1	7.16	1925.8	8.66	2329.2	8.28	2227.0	8.96	2409.9	2223.0
Check May 31	2	6.98	1877.3	8.78	2361.5	7.76	2087.1	7.96	2140.9	2116.7
1000 gpa May 31	3	7.82	2103.3	8.38	2253.9	8.74	2350.7	7.8	2097.9	2201.4
2000 gpa May 31	4	7.58	2038.7	8.8	2366.8	9.38	2522.8	8.12	2184.0	2278.1
3000 gpa May 31	5	7.76	2087.1	9	2420.6	8.38	2253.9	8.76	2356.1	2279.4
Check June13	6	7.02	1888.1	7.82	2103.3	7.88	2119.4	7.58	2038.7	2037.4
1000 gpa June 13	7	7.92	2130.2	8.78	2361.5	7.64	2054.9	7.9	2124.8	2167.8
2000 gpa June 13	8	7.8	2097.9	8.62	2318.4	8.42	2264.6	7.34	1974.2	2163.8
3000 gpa June 13	9	7.92	2130.2	9.18	2469.1	8.32	2237.7	8.3	2232.4	2267.3
Check June 30	10	6	1613.8	5.88	1581.5	5.8	1560.0	7.04	1893.5	1662.2
1000 gpa June 30	11	6.12	1646.0	6.38	1716.0	6.62	1780.5	5.74	1543.8	1671.6
2000 gpa June 30	12	6.04	1624.5	6.88	1850.4	6.52	1753.6	6	1613.8	1710.6
3000 gpa June 30	13	6.14	1651.4	6.84	1839.7	5.98	1608.4	7.28	1958.0	1764.4
		Mean	1908.8		2151.7		2063.1		2043.7	

Site #2 South Of Highway - Data entered and checked and formuals changed Sept. 19, 2002

	Treatment	Rep1		Rep2		Rep3		Rep4		Mean
		kg	kg/ha	kg	kg/ha	kg	kg/ha	kg	kg/ha	kg/ha
Check No Dis	1	3.84	1032.8	5.02	1350.2	6.9	1855.8	7.02	1888.1	1531.7
Check May 31	2	4.56	1226.5	6.54	1759.0	6.46	1737.5	6.7	1802.0	1631.2
1000 gpa May 31	3	3.58	962.9	5.64	1516.9	6.24	1678.3	8.4	2259.3	1604.3
2000 gpa May 31	4	7.80	2097.9	5.32	1430.9	12.4	3335.1	7.18	1931.1	2198.7
3000 gpa May 31	5	4.02	1081.2	6.84	1839.7	6.58	1769.8	6.92	1861.2	1638.0
Check June 13	6	4.26	1145.8	4.96	1334.0	6.6	1775.1	7.94	2135.5	1597.6
1000 gpa June 13	7	4.64	1248.0	6.68	1796.7	7.7	2071.0	8.24	2216.2	1833.0
2000 gpa June 13	8	4.06	1092.0	6.3	1694.4	6.66	1791.3	8.2	2205.5	1695.8
3000 gpa June 13	9	4.52	1215.7	7.18	1931.1	6.68	1796.7	8.54	2296.9	1810.1
Check June 30	10	3.54	952.1	4.56	1226.5	5.9	1586.9	5.38	1447.0	1303.1
1000 gpa June 30	11	3.28	882.2	5.72	1538.5	5.08	1366.3	7.12	1915.0	1425.5
2000 gpa June 30	12	3.76	1011.3	5.66	1522.3	5.04	1355.6	5.8	1560.0	1362.3
3000 gpa June 30	13	4.54	1221.1	3.94	1059.7	5.56	1495.4	6.6	1775.1	1387.8
			1166.9		1538.5		1816.5		1945.6	

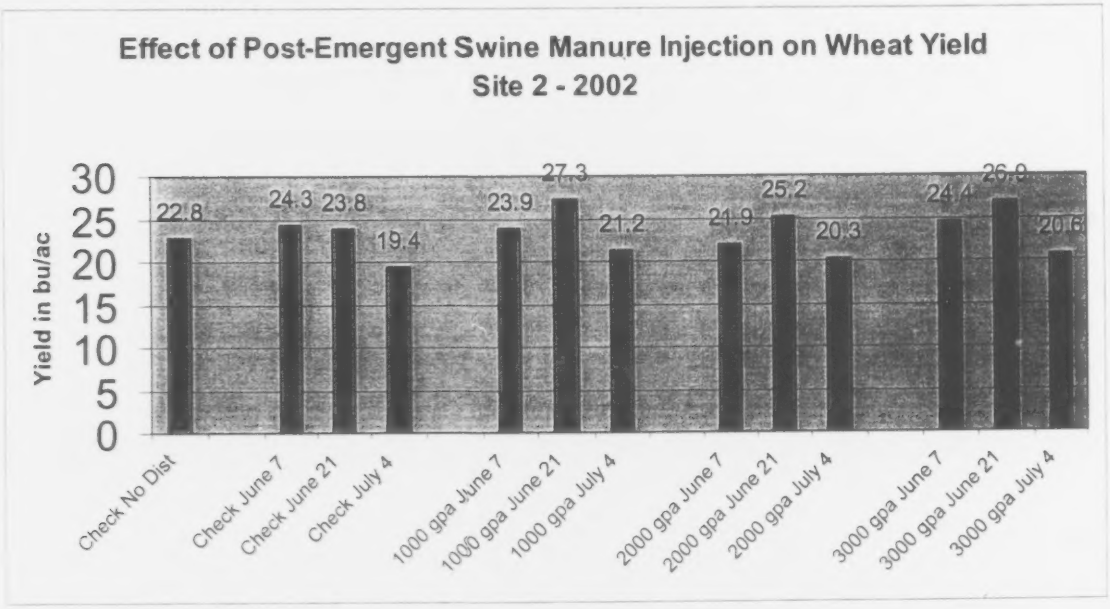
5200G P. Emergent Manure - Site #1 - Fall 2002 Yield Data in Bushels/ac

Treatment	bu/ac
Check No Dist	33.1
Check June 7	31.5
Check June 21	30.3
Check July 4	24.7
1000 gpa June 7	32.8
1000 gpa June 21	32.3
1000 gpa July 4	24.9
2000 gpa June 7	33.9
2000 gpa June 21	32.2
2000 gpa July 4	25.4
3000 gpa June 7	33.9
3000 gpa June 21	33.7
3000 gpa July 4	26.2



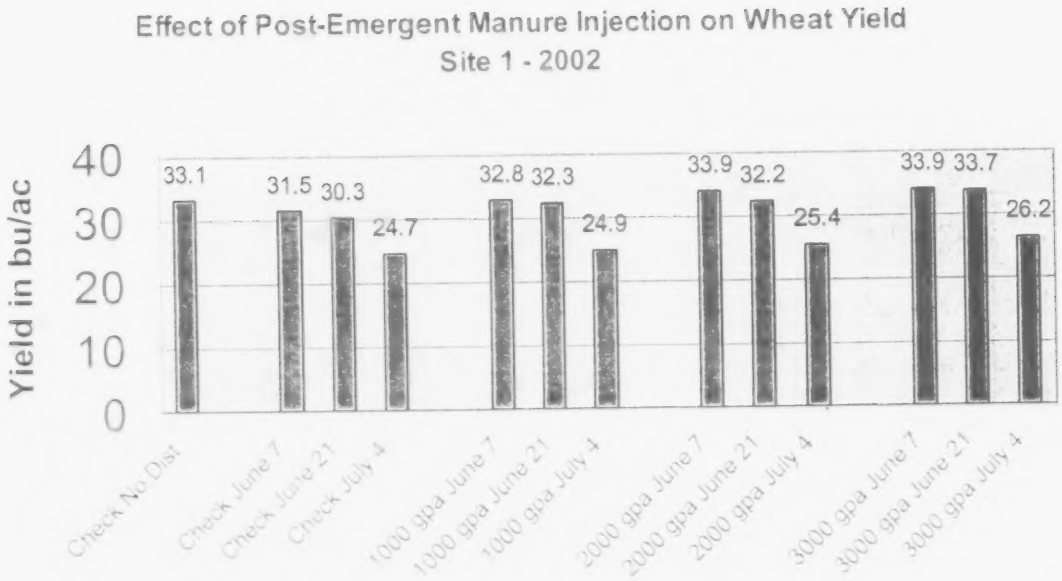
5200G P. Emergent Manure - Site #2 - Fall 2002 Yield Data in Bushels/ac

Treatment	bu/ac
Check No Dist	22.8
Check June 7	24.3
Check June 21	23.8
Check July 4	19.4
1000 gpa June 7	23.9
1000 gpa June 21	27.3
1000 gpa July 4	21.2
2000 gpa June 7	21.9
2000 gpa June 21	25.2
2000 gpa July 4	20.3
3000 gpa June 7	24.4
3000 gpa June 21	26.9
3000 gpa July 4	20.6



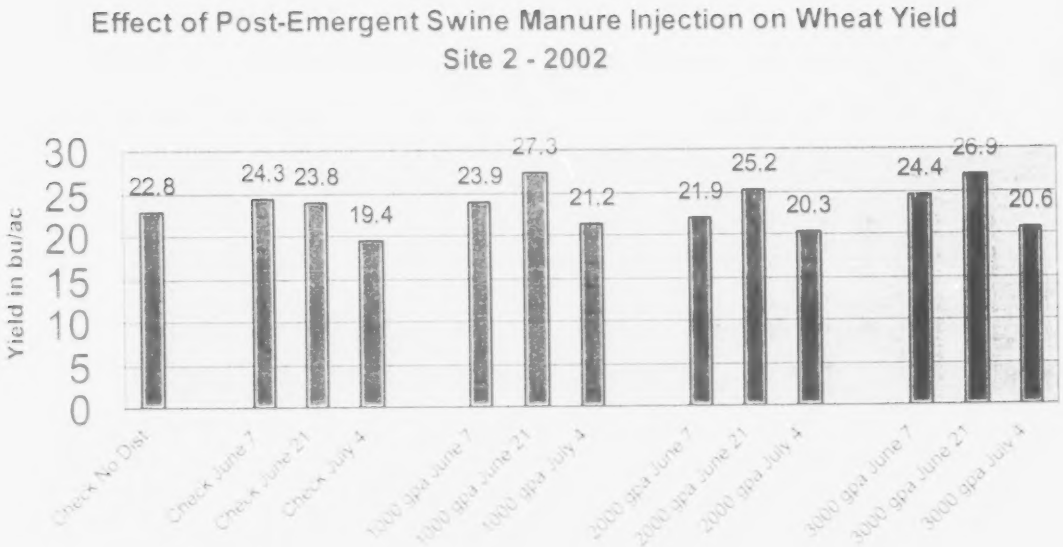
5200G P. Emergent Manure - Site #1 - Fall 2002 Yield Data in Bushels/ac

Treatment	bu/ac
Check No Dist	33.1
Check June 7	31.5
Check June 21	30.3
Check July 4	24.7
1000 gpa June 7	32.8
1000 gpa June 21	32.3
1000 gpa July 4	24.9
2000 gpa June 7	33.9
2000 gpa June 21	32.2
2000 gpa July 4	25.4
3000 gpa June 7	33.9
3000 gpa June 21	33.7
3000 gpa July 4	26.2



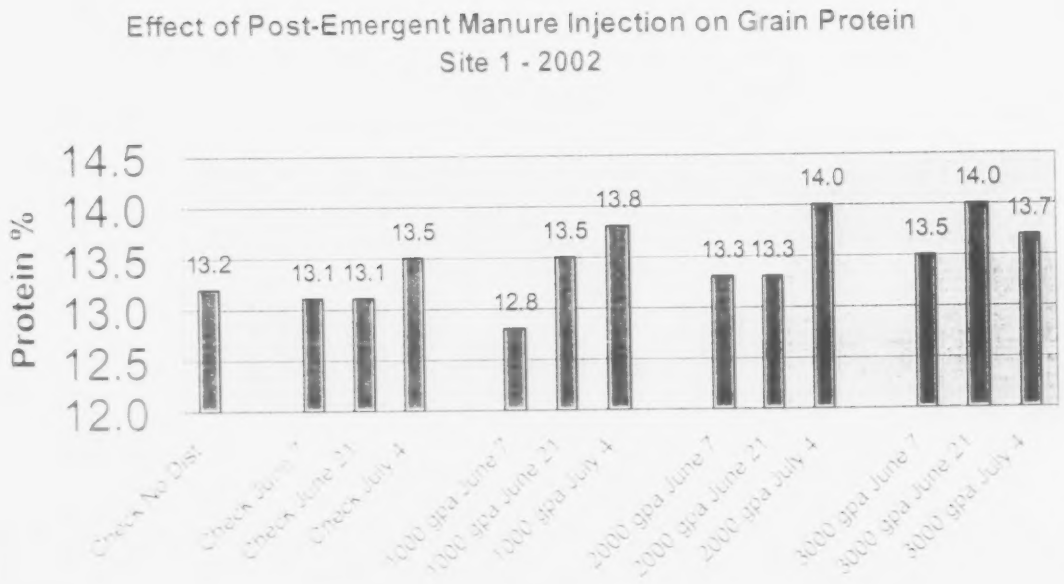
5200G P. Emergent Manure - Site #2 - Fall 2002 Yield Data in Bushels/ac

Treatment	bu/ac
Check No Dist	22.8
Check June 7	24.3
Check June 21	23.8
Check July 4	19.4
1000 gpa June 7	23.9
1000 gpa June 21	27.3
1000 gpa July 4	21.2
2000 gpa June 7	21.9
2000 gpa June 21	25.2
2000 gpa July 4	20.3
3000 gpa June 7	24.4
3000 gpa June 21	26.9
3000 gpa July 4	20.6



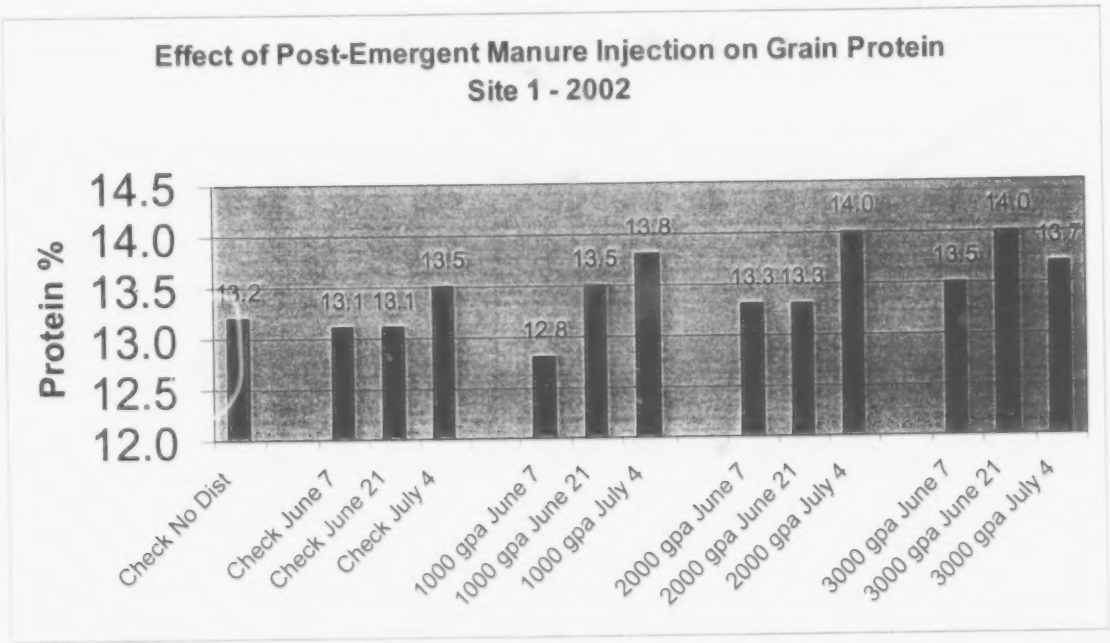
5200G P. Emergent Manure - Site #1 - Fall 2002 Grain Protein %

Treatment	% Protein
Check No Dist	13.2
Check June 7	13.1
Check June 21	13.1
Check July 4	13.5
1000 gpa June 7	12.8
1000 gpa June 21	13.5
1000 gpa July 4	13.8
2000 gpa June 7	13.3
2000 gpa June 21	13.3
2000 gpa July 4	14.0
3000 gpa June 7	13.5
3000 gpa June 21	14.0
3000 gpa July 4	13.7



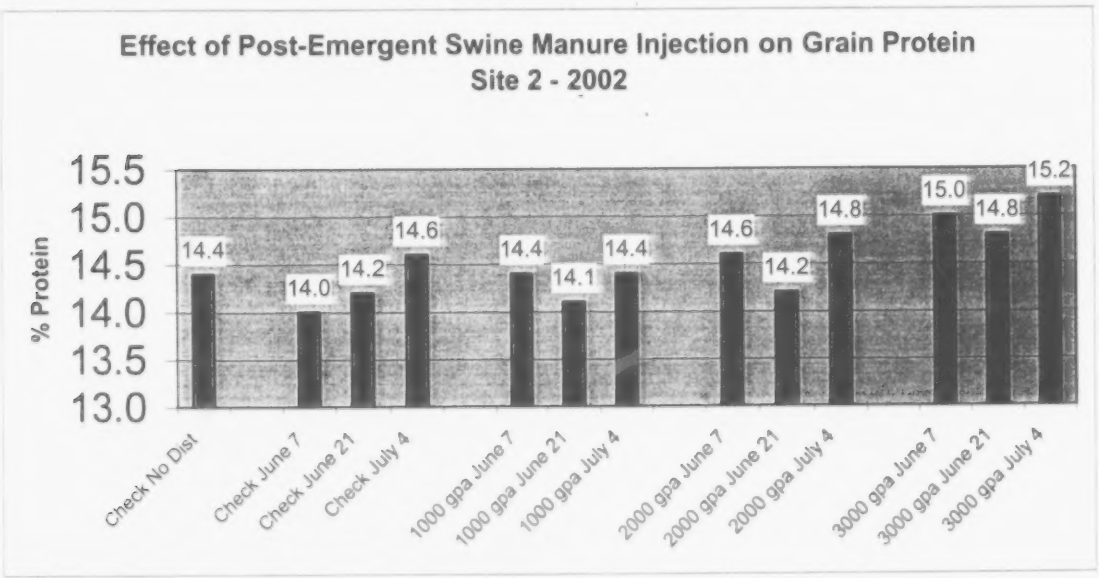
5200G P. Emergent Manure - Site #1 - Fall 2002 Grain Protein %

Treatment	% Protein
Check No Dist	13.2
Check June 7	13.1
Check June 21	13.1
Check July 4	13.5
1000 gpa June 7	12.8
1000 gpa June 21	13.5
1000 gpa July 4	13.8
2000 gpa June 7	13.3
2000 gpa June 21	13.3
2000 gpa July 4	14.0
3000 gpa June 7	13.5
3000 gpa June 21	14.0
3000 gpa July 4	13.7



5200G P. Emergent Manure - Site #2 - Fall 2002 Grain Protein

Treatment	% Protein
Check No Dist	14.4
Check June 7	14.0
Check June 21	14.2
Check July 4	14.6
1000 gpa June 7	14.4
1000 gpa June 21	14.1
1000 gpa July 4	14.4
2000 gpa June 7	14.6
2000 gpa June 21	14.2
2000 gpa July 4	14.8
3000 gpa June 7	15.0
3000 gpa June 21	14.8
3000 gpa July 4	15.2



APPENDIX IV

Appendix IV

2003 Project Data

Post-Emergent Swine Manure on Wheat or Barley 5200G

Yield, Protein and Grain Moisture - Fall 2003
August 27/03
Sample weights proofed Aug 27/03 Protein and Moisture Proofed Sept.18/03

Treatment	N	Grain Yld. kg ha^{-1}		Protein Content %		Moisture Content %	
1. Check-no disturbance	4	1957	224	11.9	1.0	10.7	0.2
2. Check-disturbed May 29	4	2129	470	12.0	0.8	10.6	0.1
3. 1000 gpa May 29	4	2061	185	13.3	0.6	10.8	0.2
4. 2000 gpa May 29	4	2148	349	14.6	0.7	10.6	0.3
5. 3000 gpa May 29	4	2183	173	14.6	0.5	10.8	0.1
6. Check-disturbed June 12	4	2060	254	12.4	0.9	10.7	0.1
7. 1000 gpa June 12	4	2077	349	13.9	0.8	10.6	0.1
8. 2000 gpa June 12	4	2129	513	14.6	0.6	10.5	0.2
9. 3000 gpa June 12	4	3239	1566	15.0	0.5	10.7	0.3
10. Check-disturbed June 24	4	2788	2007	12.7	1.4	10.6	0.1
11. 1000 gpa June 24	4	2695	1695	14.1	1.5	10.4	0.2
12. 2000 gpa June 24	4	2038	300	14.3	1.2	10.7	0.3
13. 3000 gpa June 24	4	2132	120	15.3	0.5	10.5	0.1
	LSD $_{(0.10)}$	982.04		1.0		0.2	

Note 1: N= Number of Observations
2: Means in the first column are followed by std.dev. In the second column.

Concentrations in *Hog Manure* Applied at <u>Burr Post Emergent Trials 2003</u>

Tot. N	NH4	NO3	Tot. P	Avail P	K	Ca	Mg	Cu	Fe	Mn	Zn	B	Na
ug/ml													
1315	1015	-	39	0.1	981	359	120	n.d.	14	2.4	7.2	19	694

Application rates of nutrient in kg/ha

Rate gpa														
1000	13	10	-	0.4	0.001	9.8	3.6	1.2	-	0.14	0.02	0.07	0.19	6.9

Post Emergent Swine Manure on Wheat or Barley 5200G
Yield, Protein and Grain Moisture - Fall 2003
August 27/03
Sample weights proofed Aug 27/03 Protein and Moisture Proofed Sept.18/03

Plot	Treatment	Sample Wt. Kg.	kg/ha	Protein %	Moisture
1	1	4.92	1814	11.1	10.8
2	2	4.98	1836	12.0	10.7
3	3	5.30	1954	12.4	10.9
4	4	4.90	1806	13.9	10.9
5	5	6.20	2285	14.4	10.8
6	6	5.50	2027	11.3	10.8
7	7	5.78	2131	13.6	10.6
8	8	5.58	2057	15.1	10.7
9	9	15.10	5566	15.7	10.6
10	10	15.70	5787	13.9	10.6
11	11	13.90	5124	15.7	10.1
12	12	5.20	1917	15.9	10.4
13	13	5.58	2057	15.7	10.5
14	10	4.76	1755	13.8	10.5
15	6	6.00	2212	13.0	10.5
16	13	5.70	2101	15.2	10.6
17	1	6.20	2285	12.1	10.5
18	4	6.42	2367	15.3	10.2
19	3	6.18	2278	13.4	10.4
20	8	6.76	2492	14.1	10.2
21	7	6.70	2470	12.9	10.5
22	12	6.14	2263	13.1	10.7
23	9	7.18	2647	14.7	10.4
24	11	6.42	2367	12.8	10.5
25	5	6.44	2374	14.0	10.7
26	2	7.08	2610	11.5	10.5

27	11	3.10	1192	15.0	10.4
28	8	3.72	1430	15.1	10.5
29	4	4.94	1899	15.0	10.7
30	3	4.86	1868	13.7	10.8
31	6	4.46	1715	13.3	10.7
32	12	4.28	1669	14.0	11.1
33	5	5.20	2028	14.6	10.9
34	9	5.56	2168	14.9	11.1
35	1	4.92	1919	13.3	10.8
36	2	4.18	1630	13.2	10.6
37	7	4.16	1622	14.3	10.8
38	13	5.28	2059	15.7	10.5
39	10	5.18	2020	11.9	10.7
40	5	5.24	2044	15.3	10.6
41	1	4.64	1810	11.1	10.6
42	10	4.08	1591	11.0	10.5
43	13	5.92	2309	14.6	10.5
44	4	6.46	2519	14.2	10.4
45	12	5.90	2301	14.0	10.4
46	2	6.26	2441	11.4	10.6
47	6	5.86	2285	12.0	10.8
48	8	6.50	2535	13.9	10.5
49	11	5.38	2098	12.7	10.4
50	3	5.50	2145	13.5	10.9
51	7	5.34	2083	14.6	10.6
52	9	6.60	2574	14.7	10.8

Post Emergent Swine Manure 5200G
Yield Data August 27/03
Proofed Aug 27/03

	Yield in kg/ha				Mean	Mean
Treatment	**Rep 1.**	**Rep 2**	**Rep 3**	**Rep4**	**kg/ha**	**bu/ac**
1. Check-no disturbance	1814	2285	1919	1810	1957	29.1
2. Check-disturbed May 29	1836	2610	1630	2441	2129	31.7
3. 1000 gpa May 29	1954	2278	1868	2145	2061	30.6
4. 2000 gpa May 29	1806	2367	1899	2519	2148	31.9
5. 3000 gpa May 29	2285	2374	2028	2044	2183	32.5
6. Check-disturbed June 12	2027	2212	1715	2285	2060	30.6
7. 1000 gpa June 12	2131	2470	1622	2083	2077	30.9
8. 2000 gpa June 12	2057	2492	1430	2535	2129	31.6
9. 3000 gpa June 12	1961	2647	2168	2574	2338	34.8
10. Check-disturbed June 24	1851	1755	2020	1591	1804	26.8
11. 1000 gpa June 24	2109	2367	1192	2098	1942	28.9
12. 2000 gpa June 24	1917	2263	1669	2301	2038	30.3
13. 3000 gpa June 24	2057	2101	2059	2309	2132	31.7

Post-Emergent Swine Manure 5200G
Protein Data /03
Proofed Sept. 18/03

	Protein %				
Treatment	**Rep 1.**	**Rep 2**	**Rep 3**	**Rep4**	**Mean Protein**
1. Check-no disturbance	11.1	12.1	13.3	11.1	11.9
2. Check-disturbed May 29	12.0	11.5	13.2	11.4	12.0
3. 1000 gpa May 29	12.4	13.4	13.7	13.5	13.3
4. 2000 gpa May 29	13.9	15.3	15.0	14.2	14.6
5. 3000 gpa May 29	14.4	14.0	14.6	15.3	14.6
6. Check-disturbed June 12	11.3	13.0	13.3	12.0	12.4
7. 1000 gpa June 12	13.6	12.9	14.3	14.6	13.9
8. 2000 gpa June 12	15.1	14.1	15.1	13.9	14.6
9. 3000 gpa June 12	15.7	14.7	14.9	14.7	15.0
10. Check-disturbed June 24	13.9	13.8	11.9	11.0	12.7
11. 1000 gpa June 24	15.7	12.8	15.0	12.7	14.1
12. 2000 gpa June 24	15.9	13.1	14.0	14.0	14.3
13. 3000 gpa June 24	15.7	15.2	15.7	14.6	15.3

Post-Emergent Swine Manure 5200G
Moisture Data /03
Proofed Sept. 18/03

	Moisture Content %				
Treatment	**Rep 1.**	**Rep 2**	**Rep 3**	**Rep4**	**Mean %**
1. Check-no disturbance	10.8	10.5	10.8	10.6	10.7
2. Check-disturbed May 29	10.7	10.5	10.6	10.6	10.6
3. 1000 gpa May 29	10.9	10.4	10.8	10.9	10.8
4. 2000 gpa May 29	10.9	10.2	10.7	10.4	10.6
5. 3000 gpa May 29	10.8	10.7	10.9	10.6	10.8
6. Check-disturbed June 12	10.8	10.5	10.7	10.8	10.7
7. 1000 gpa June 12	10.6	10.5	10.8	10.6	10.6
8. 2000 gpa June 12	10.7	10.2	10.5	10.5	10.5
9. 3000 gpa June 12	10.6	10.4	11.1	10.8	10.7
10. Check-disturbed June 24	10.6	10.5	10.7	10.5	10.6
11. 1000 gpa June 24	10.1	10.5	10.4	10.4	10.4
12. 2000 gpa June 24	10.4	10.7	11.1	10.4	10.7
13. 3000 gpa June 24	10.5	10.6	10.5	10.5	10.5